

**Continuing Education Class
Diesel Retraining**

- I. Orientation**
 - A. Expectations**
 - B. Roster**
 - C. Pre-Test**

- II. Diesel Technology**
 - A. Diesel Engine Principles**
 - 1. Review four-cycle system**
 - a. Handout**
 - b. Overhead**

 - 2. Intake System**
 - a. Handout**
 - b. Overhead**

 - 3. Fuel Systems**
 - a. Handout**
 - b. Overhead**

 - 4. Engine Fundamentals**
 - a. Slide presentation (Engine Components)**

 - 5. Fuels and Emissions**
 - a. Diesel fuel**
 - b. Fuels and emissions test**

- III. Preventive Maintenance**
 - A. Diesel Engine Checklist**
 - 1. Preventive Maintenance Test**

 - B. Cooling System**

 - C. Intake (Handouts, Overheads)**

 - D. Exhaust System After Treatment**
 - 1. Basic emission equipment operation**

 - E. Lubrication**

 - F. Good Housekeeping Practices**
 - 1. Discussion**

- IV. Emission Testing**
 - A. Glossary of Occupational Safety and Health Terms**
 - B. Oxygen Levels**
 - C. Weights of Various Gases Compared to Air**
 - D. Gases Found in the Mine Atmosphere**
 - E. Exhaust Emissions and Emissions Testing**
- V. Virginia Diesel Equipment Regulations**
- VI. Mine Safety Health and Administration Diesel Regulations**
- VII. Virginia Board of Coal Mining Examiners Certification Requirements**

The contents of this book have been prepared for you to use during your Diesel Engine Mechanic Training

PLEASE DO NOT WRITE IN THIS MANUAL

We hope that today will be interesting and helpful in making you more aware of the hazards that you encounter each day. We also hope that you will be more aware and knowledgeable of good safety practices and procedures of your job.

We would like to encourage you to take an active part in class by asking questions and making statements or comments related to topics being discussed.

EXPECTATIONS

- * No chewing, eating, or drinking in classroom.
- * No alcoholic beverages or smoking in the building.
- * Do not ask instructor for permission to leave facility.
- * Return from breaks promptly.

Let's all begin to learn and practice more about safety!!!!

**Continuing Education
Diesel Retraining Pre-Test**

1. In what order does the four-stroke diesel engine cycle occur?
 - A. _____
 - B. _____
 - C. _____
 - D. _____

2. The large end of the connecting rod is attached to the _____ by the rod cap.
 - A. Camshaft
 - B. Piston
 - C. Crank shaft
 - D. Cylinder liner

3. How often must the intake and exhaust system be visually examined?
 - A. Daily
 - B. Every Shift
 - C. Weekly
 - D. Monthly

4. Who must perform maintenance on diesel engines?
 - A. Gob boss
 - B. Mine foreman
 - C. Chief electrician
 - D. Certified diesel mechanic

5. _____ is defined as the lowest temperature at which the fuel burns.
 - A. Methane
 - B. Antifreeze
 - C. Flash point

6. Which one of the diesel engines listed below is intended for use in areas of coal mine where non-permissible equipment is allowed?
 - A. Category A engines
 - B. Category B engines
 - C. Category C engines
 - D. Category D engines

7. How often should you mix gasoline with diesel fuel?
 - A. As often as necessary
 - B. Daily
 - C. In the winter
 - D. NEVER

8. Carbon residue is the material left after _____.
 - A. Intake
 - B. Fuel
 - C. Combustion

9. How often are emission tests required?

- A. Daily
- B. Weekly
- C. Monthly

10. When a piece of diesel equipment is receiving fuel, the engine must be _____.

- A. Washed
- B. Adjusted
- C. Stopped
- D. Lubricated

**Pre-Test
Answer Sheet**

1. Intake, compression, power, exhaust
2. C
3. B
4. D
5. C
6. B
7. D
8. C
9. B
10. C

DIESEL TECHNOLOGY

DIESEL ENGINE PRINCIPLES

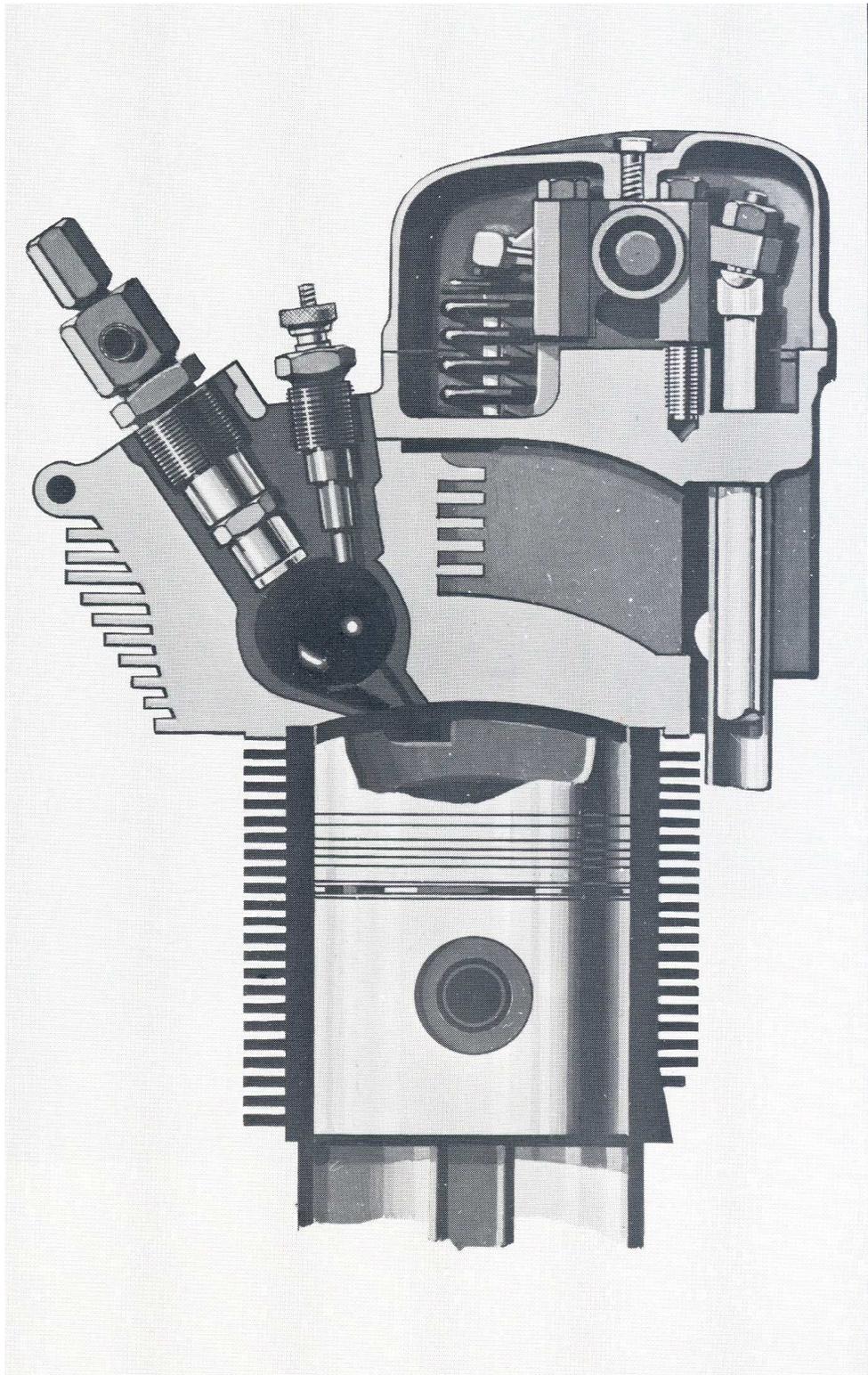
Review of Four-Cycle Systems

OVERHEAD #1

Description: Air cooled cylinder

Topics to discuss:

- A. Cooling fins
- B. Push rods
- C. Valve adjustments
- D. Rocker arm
- E. Valves
- F. Retainers
- G. Valve springs
- H. Valve seals
- I. Pre-combustion chamber
- J. Cylinder
- K. Design of piston
- L. Piston rings
- M. Wrist pin
- N. Wrist pin keepers
- O. Connecting rod
- P. Injector
- Q. Glow plug
- R. Lubrication



OVERHEAD #2

Description: Direct injection combustion systems

Topics to discuss:

- A. Piston design
- B. Turbulence of air due to piston design
- C. Type of injector
- D. Viscosity
- E. Damaged injector

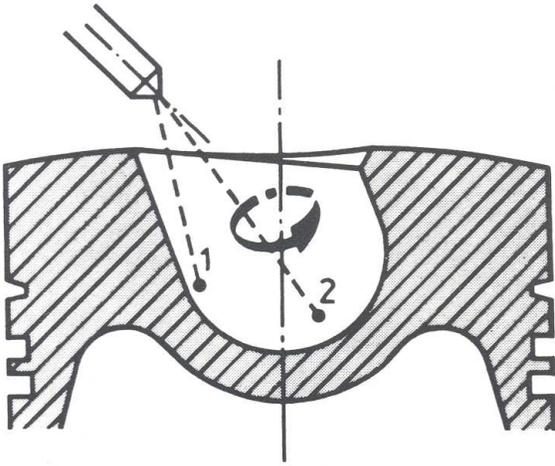


Fig. 3b: D-type combustion.

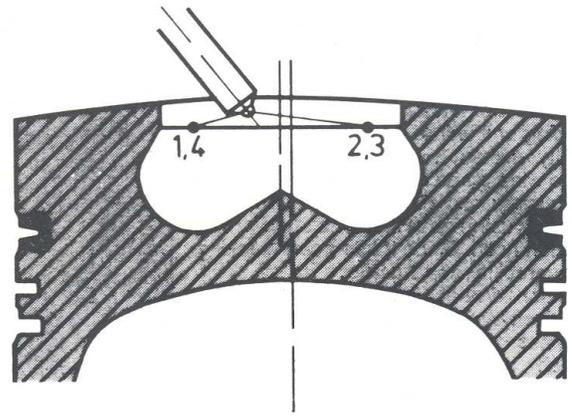
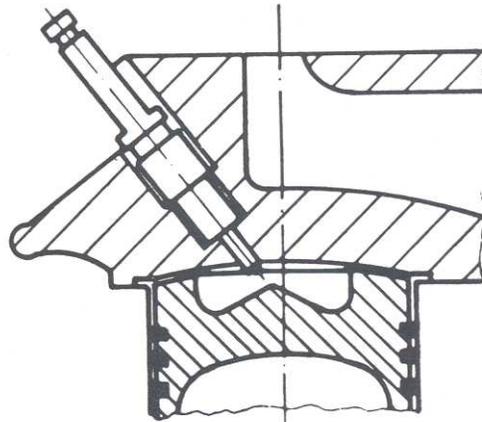


Fig. 3c: Z-type combustion.



Open piston bowl and 4-hole injector in the BFL 513 engine.

OVERHEAD #3

Description: The four-stroke principle

Topics to discuss:

- A. Order of strokes
- B. Intake, compression, power, exhaust
- C. Intake and exhaust valves
- D. Quantity of air entering the cylinder
- E. Pressure before and after combustion
- F. Temperature of compressed air
- G. Compression ratio
- H. Stress
- I. Turbulence within the combustion chamber
- J. Injection of fuel
- K. Mixing of fuel and air
- L. Timing of combustion

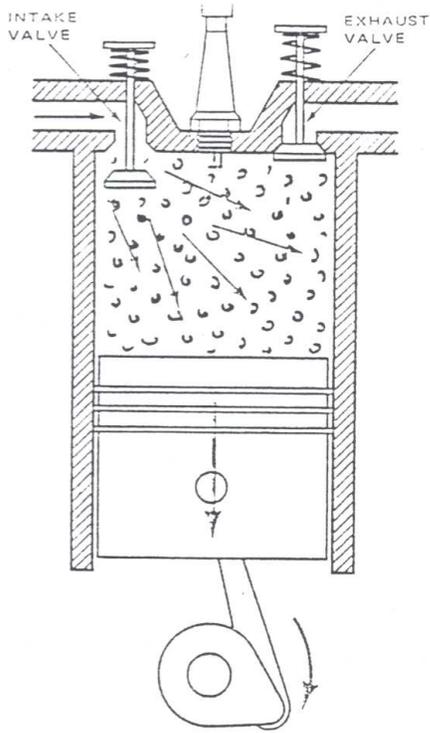


Fig. 2-8. On the intake stroke, the intake valve is open and the exhaust valve is closed.

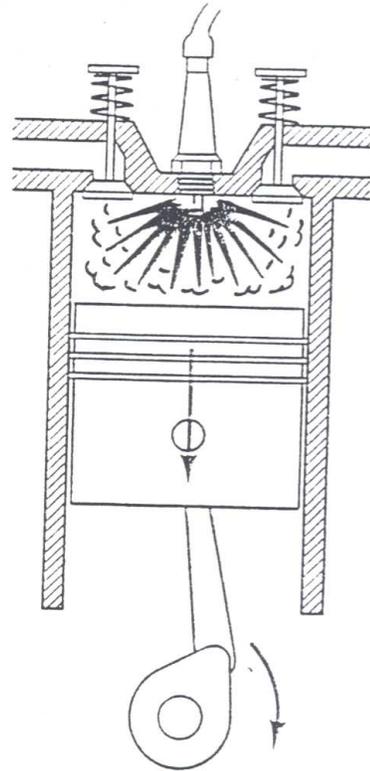


Fig. 2-10. Power stroke. Both valves are still closed.

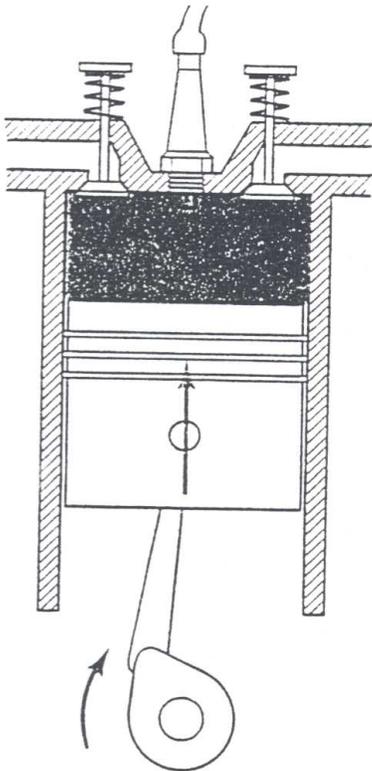


Fig. 2-9. On the compression stroke, both valves are closed.

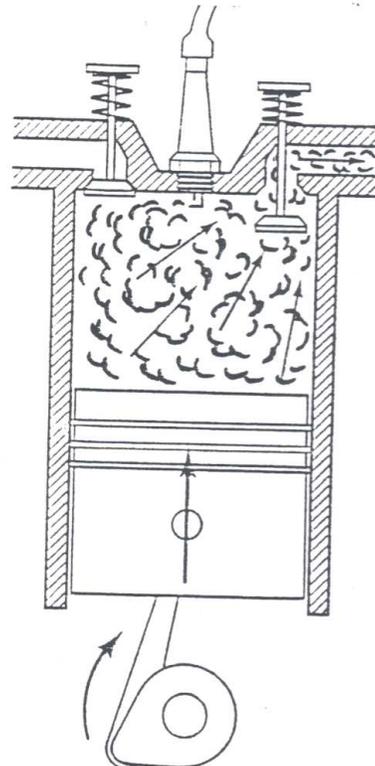


Fig. 2-11. Exhaust stroke. Exhaust valve is open; intake valve is closed.

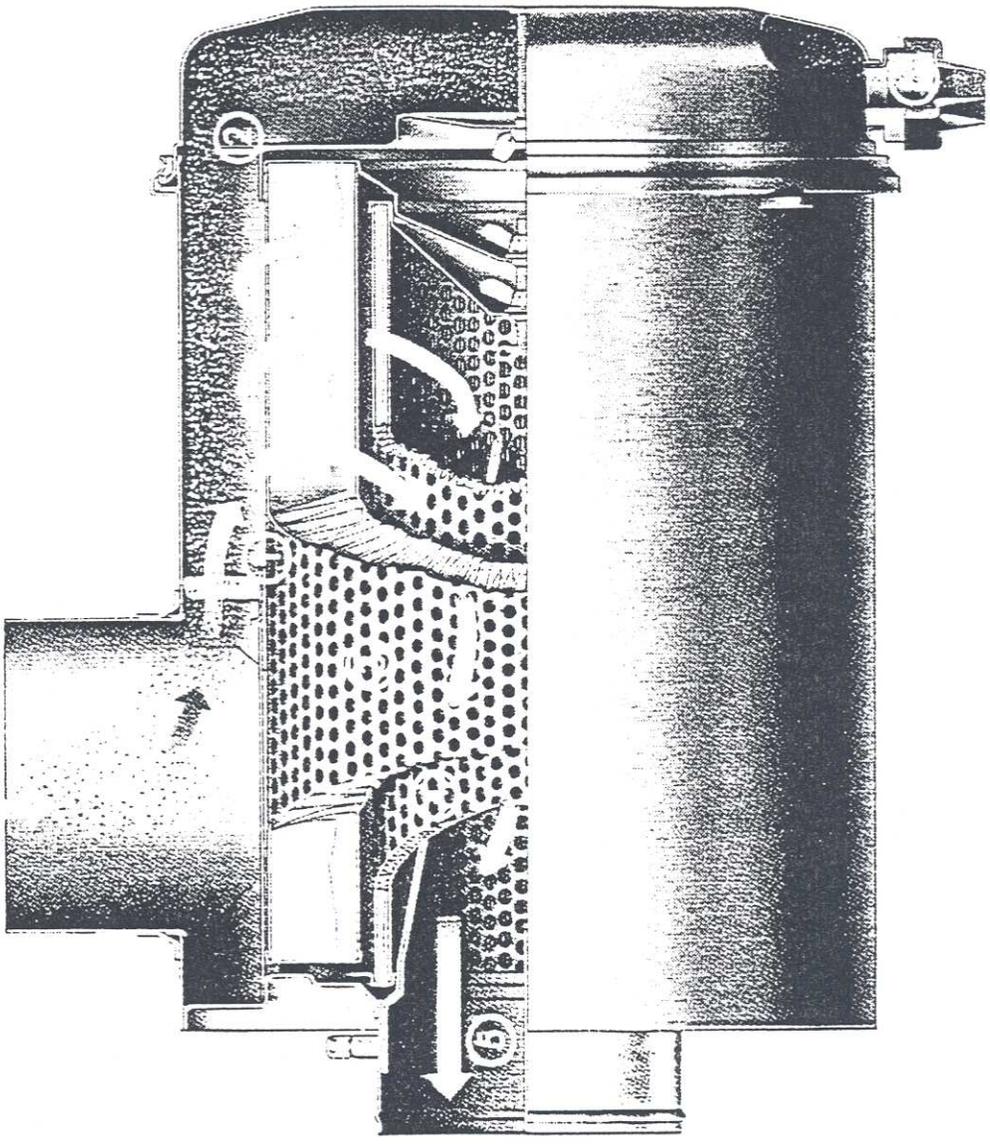
INTAKE SYSTEM

OVERHEAD #4

Description: Intake system

Topics to discuss:

- A. Environment
- B. Size of particles
- C. Area of the filter
- D. Large size particle discharge
- E. Primary and secondary filter
- F. Hose connections
- G. Replacing
- H. Pressure differential

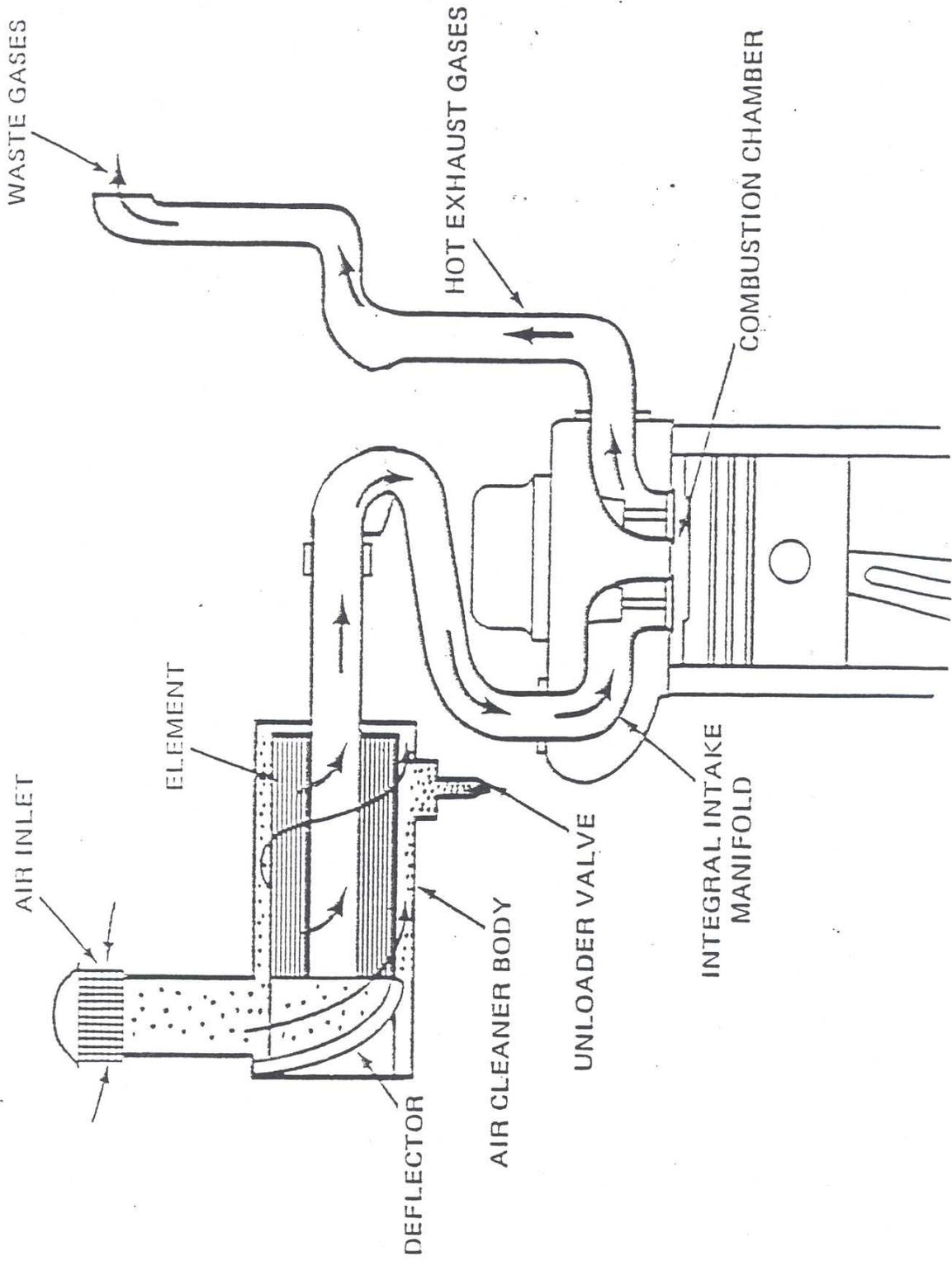


OVERHEAD #5

Description: Intake/Exhaust system

Topics to discuss:

- A. Air filtration
- B. Unloader valve
- C. Filter element
- D. Deflector
- E. Intake manifold
- F. Combustion chamber
- G. Intake/exhaust valve
- H. Exhaust manifold
- I. Exhaust pipe



FUEL SYSTEMS

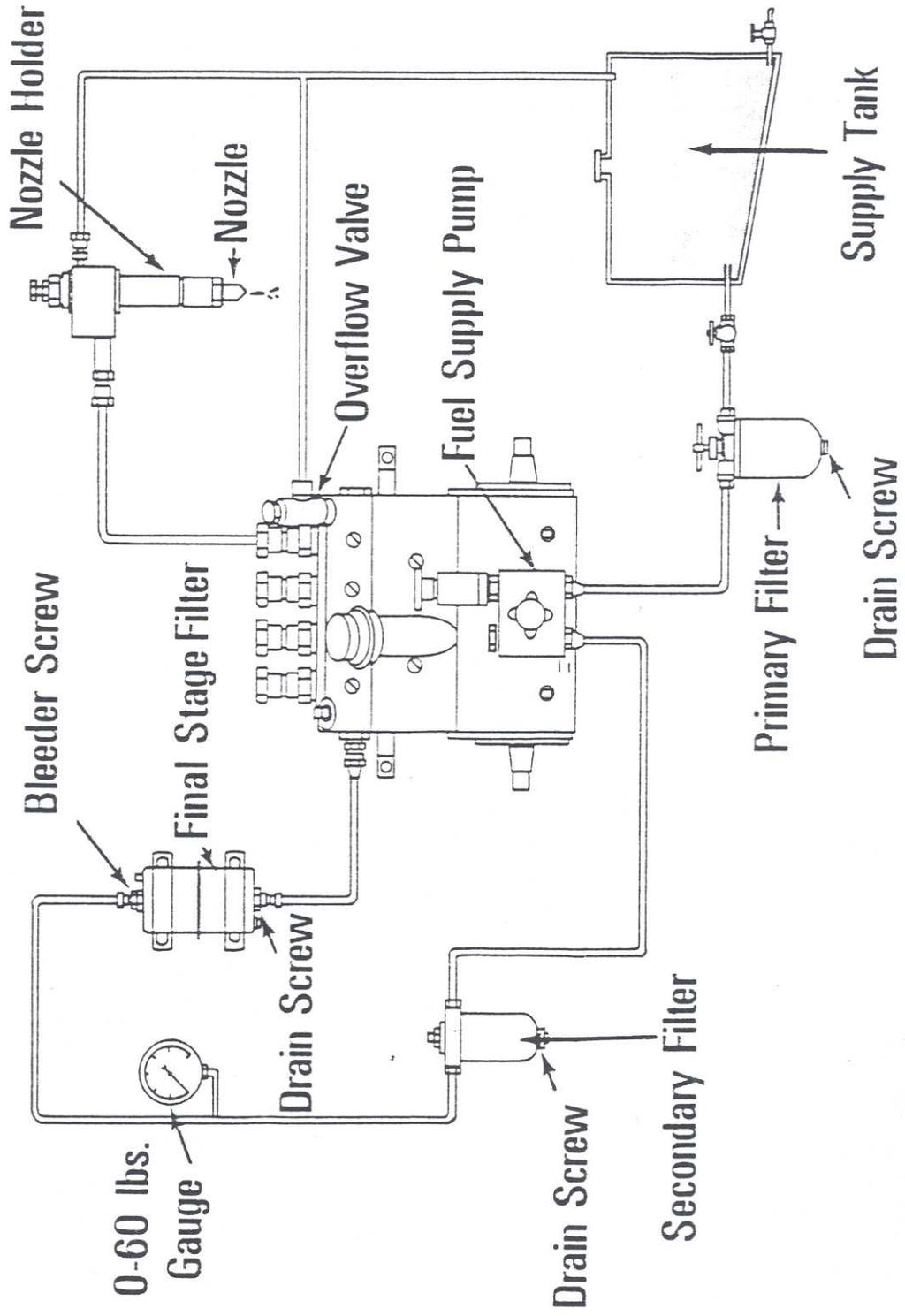
OVERHEAD #6

Description: Fuel flow

Topics to discuss:

- A. Supply tank
- B. Cut-off valve
- C. Primary filter
- D. Injection pump
- E. Fuel supply pump
- F. Secondary filter
- G. Fuel pressure “low”
- H. Final filter
- I. Fuel chamber
- J. Overflow valve
- K. Nozzle “injector”
- L. Return line

Fuel Flow



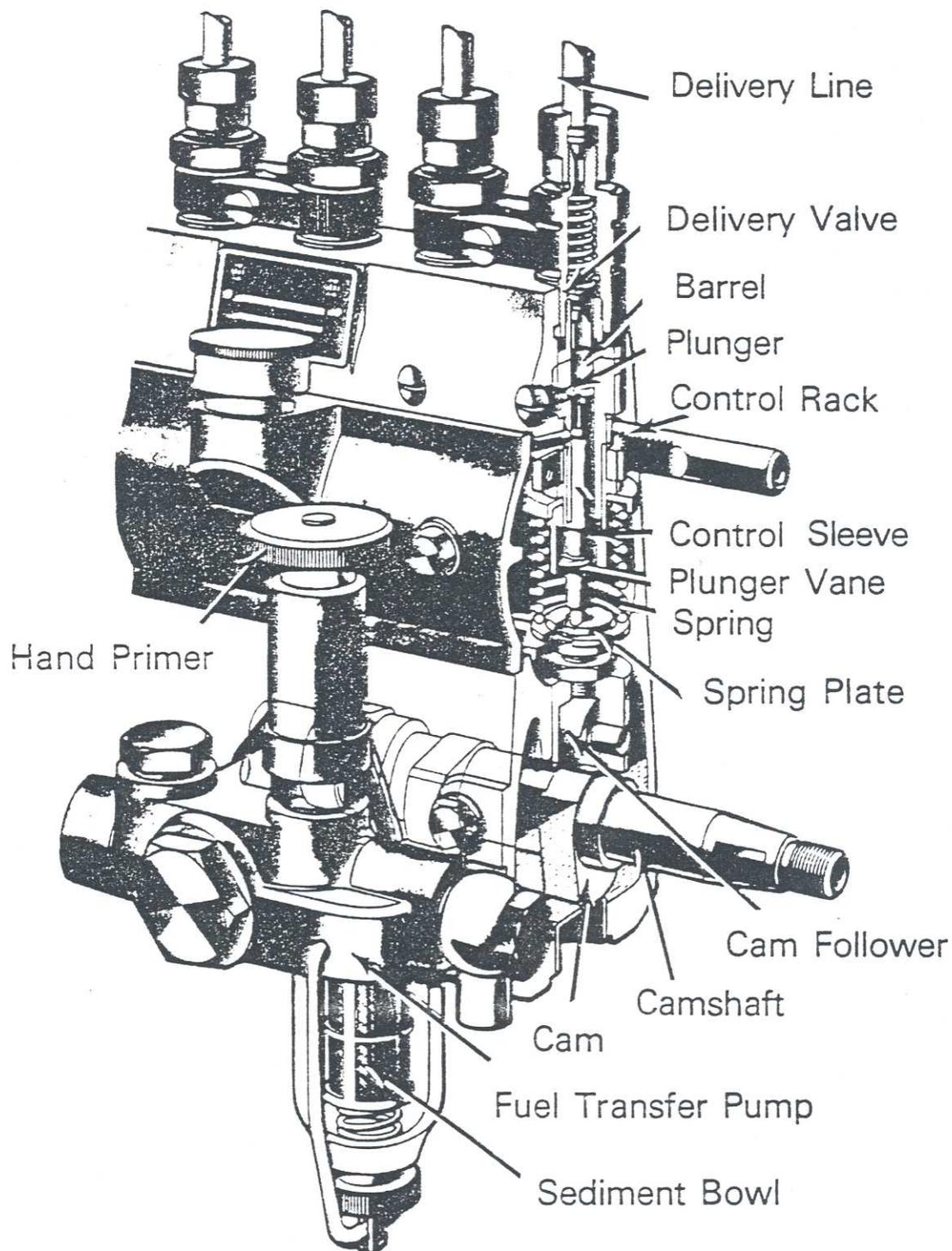
OVERHEAD #7

Description: Injection pump operation

Topics to discuss:

- A. Fuel lift pump
- B. Camshaft
- C. Cam followers
- D. Barrel & plunger assembly
- E. Control rack
- F. Delivery valve

Injection Pump Operation



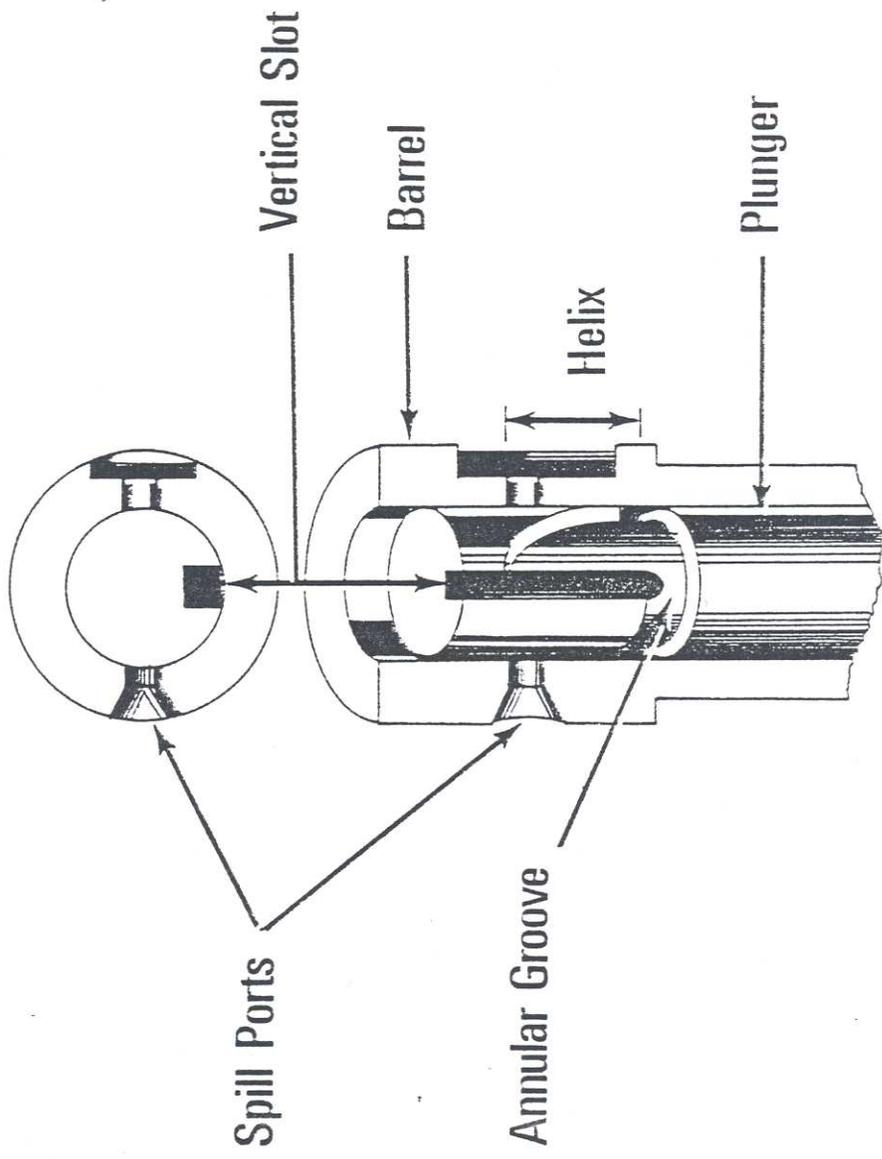
OVERHEAD #8

Description: Barrel & plunger assembly

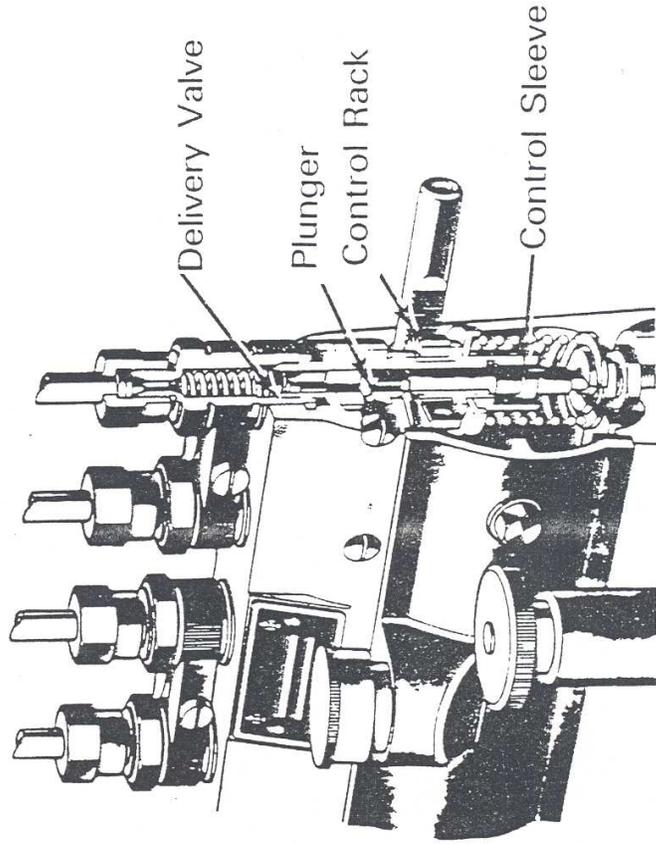
Topics to discuss:

- A. Barrel
- B. Spill ports
- C. Plunger
- D. Matched set
- E. Stroke
- F. Annular groove
- G. Vertical slot
- H. Helix
- I. Different designs

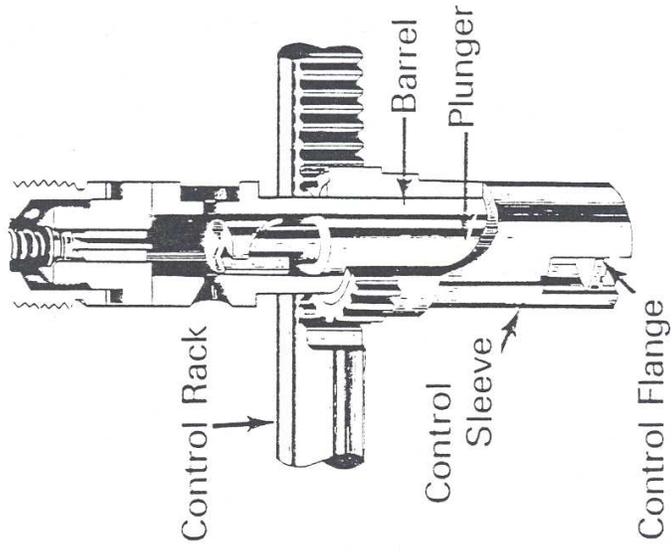
Parts And Design Of Pumping Element



Control Rack And Sleeve



Control Rack, Sleeve, and Delivery Valve



Plunger Rotation Mechanism.
(American Bosch AMBAC Industries, Inc.)

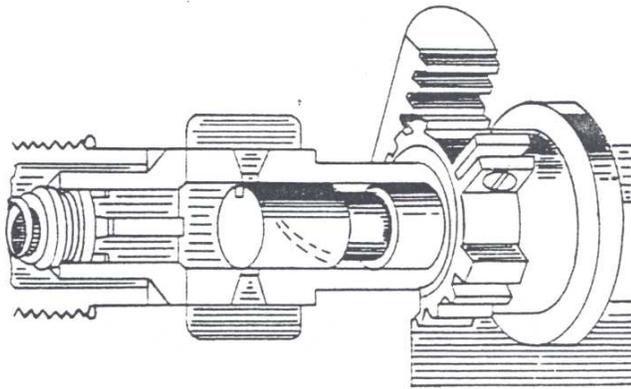
OVERHEAD #9

Description: Fuel delivery

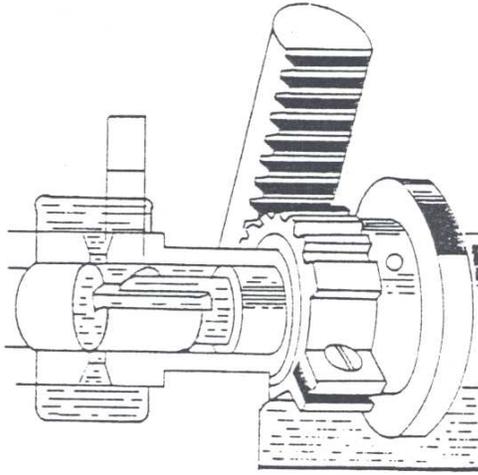
Topics to discuss:

- A. Port closure
- B. Length of stroke travel
- C. Effective delivery
- D. No fuel delivery
- E. Maximum fuel delivery

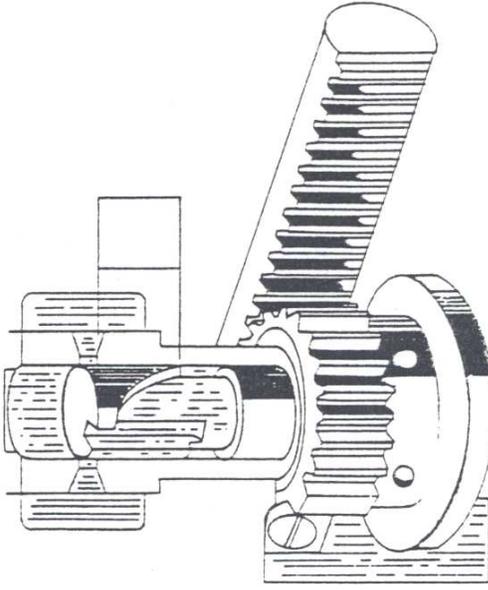
Plunger Positions At Fuel Delivery



No Fuel Delivery



Partial Fuel Delivery



Maximum Fuel Delivery

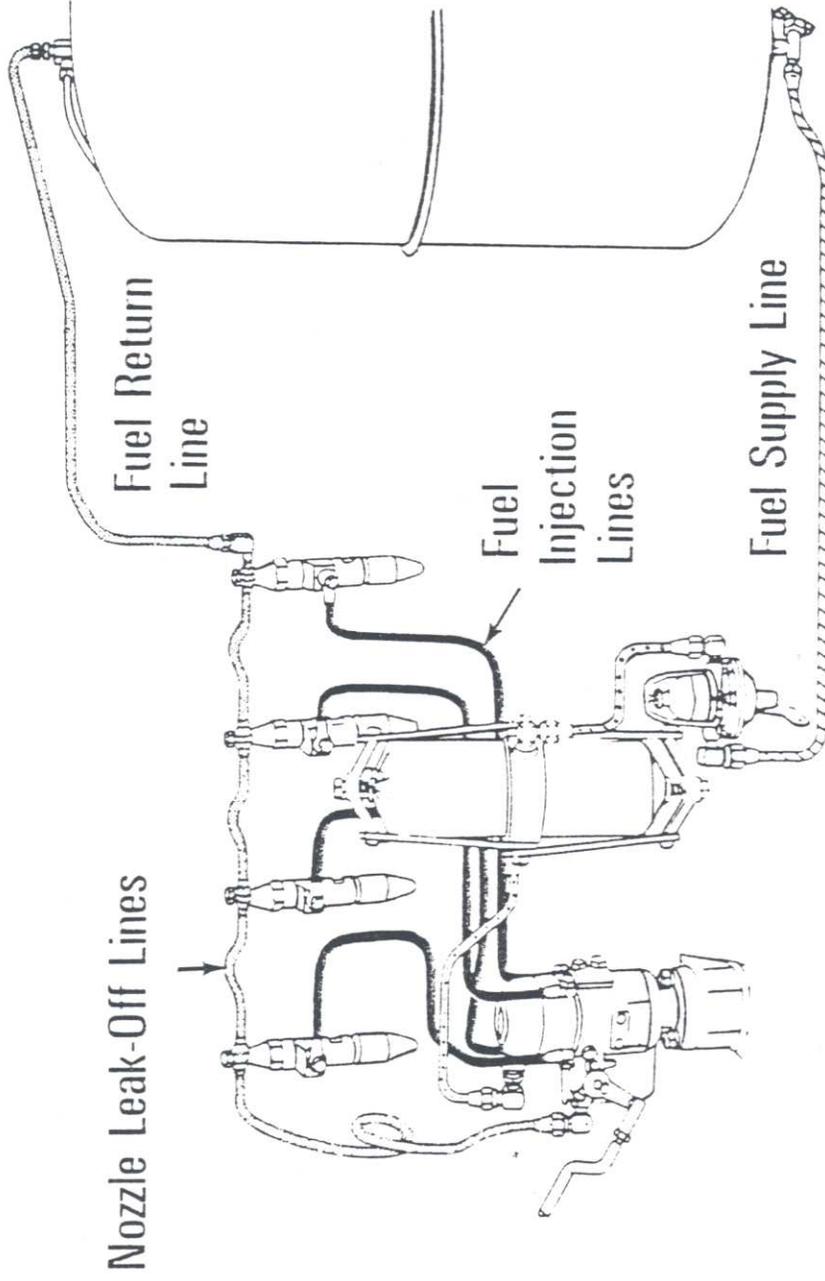
OVERHEAD #10

Description: Types of fuel lines

Topics to discuss:

- A. Low pressure
- B. High pressure
- C. No pressure
- D. Dangers included with high pressure
- E. Lines may be pressurized to 5000 psi

Types of Fuel Lines



Very High Pressure

.....

Low Pressure

□

No Pressure

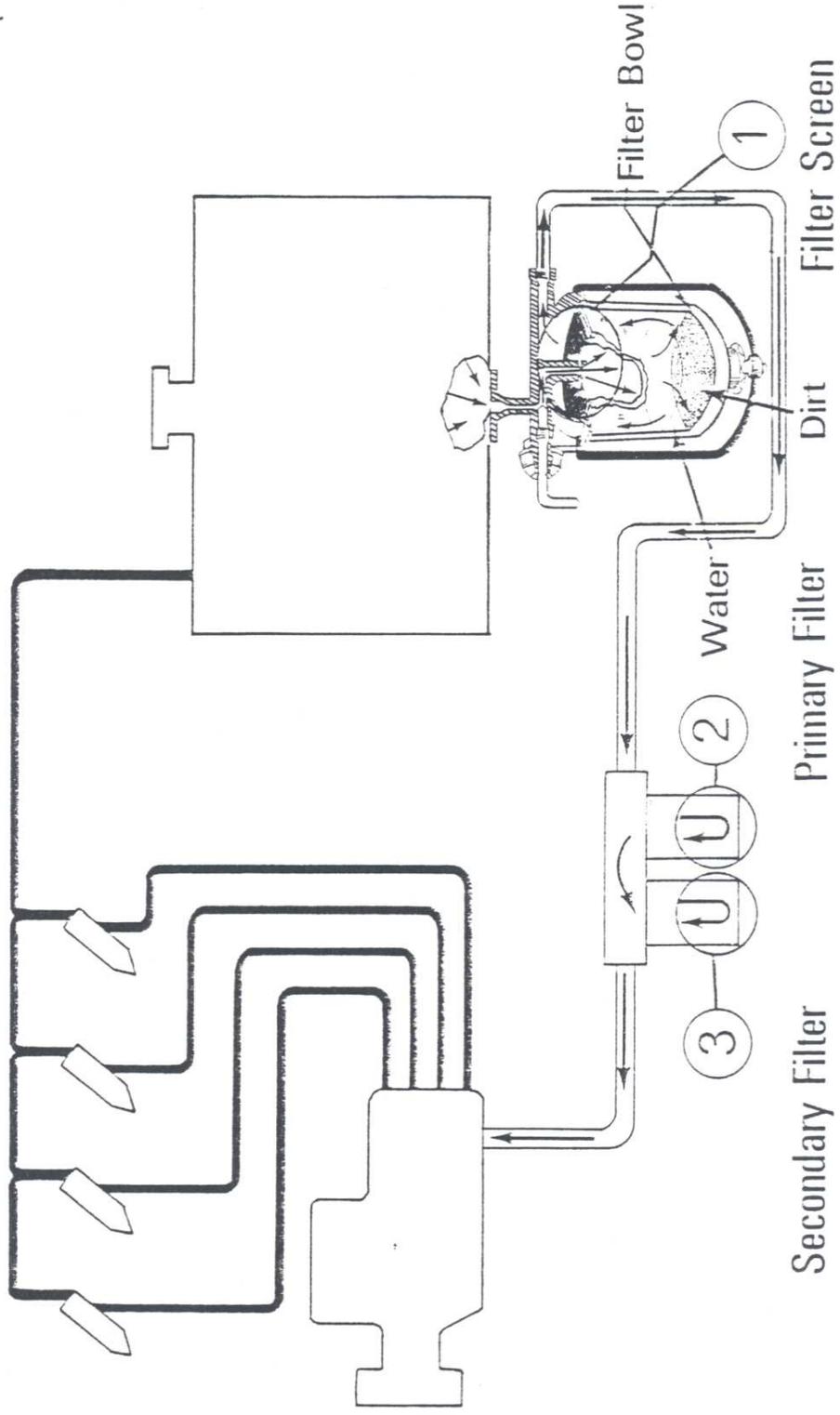
OVERHEAD #11

Description: Fuel filtration

Topics to discuss:

- A. Microns
- B. Sedimentation
- C. Water contamination
- D. Primary filter
- E. Secondary filter

Stages of Fuel Filtration



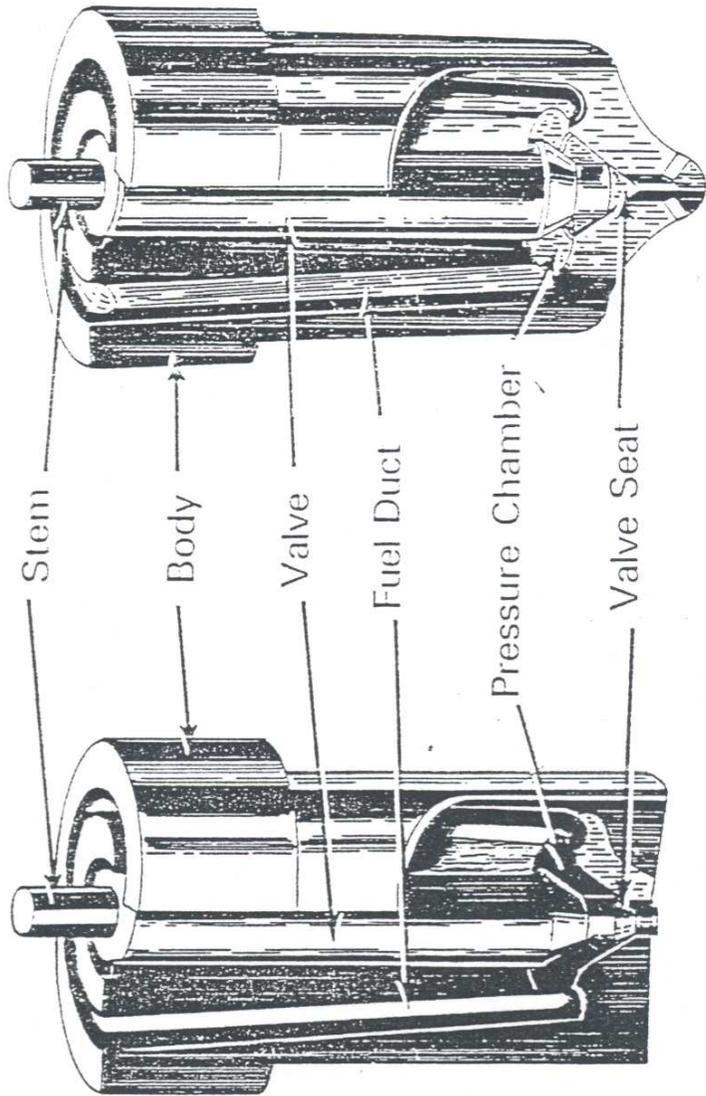
OVERHEAD #12

Description: Injection nozzles

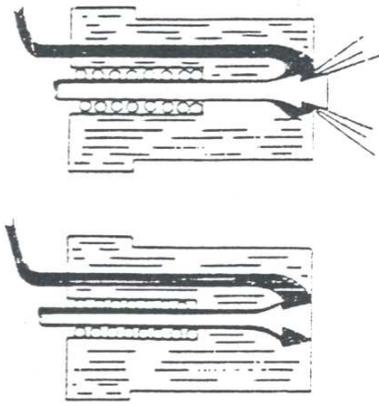
Topics to discuss:

- A. Body
- B. Valve
- C. Fuel duct
- D. Pressure chamber
- E. Valve seat
- F. Inward opening
- G. Outward opening
- H. Pintle-type
- I. Orifice-type
- J. Sophisticated relief valve

Nozzle Valve Assembly

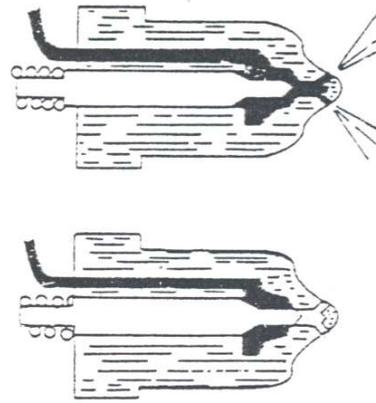


Pintle



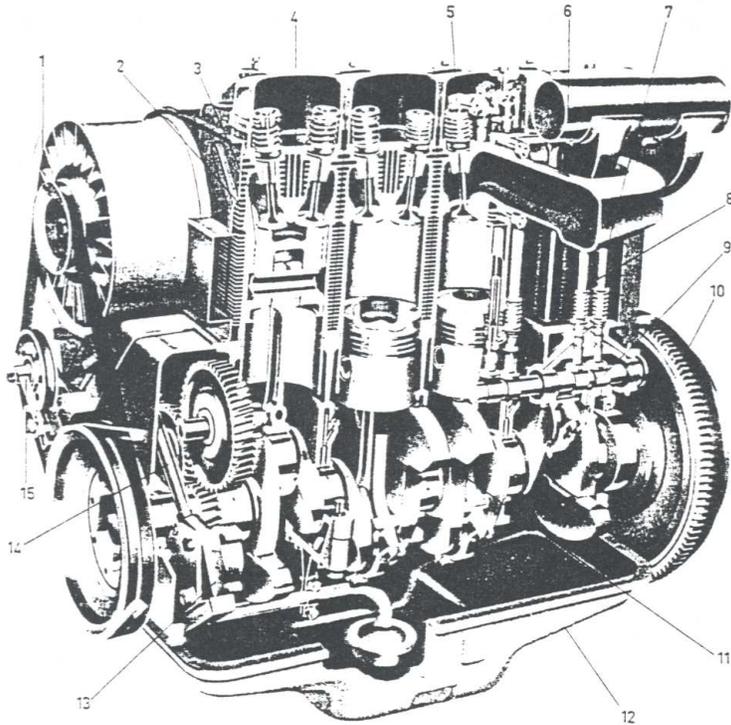
Closed Open
Outward-Opening

Pintle-Type



Closed Open
Inward-Opening
Hole-Type

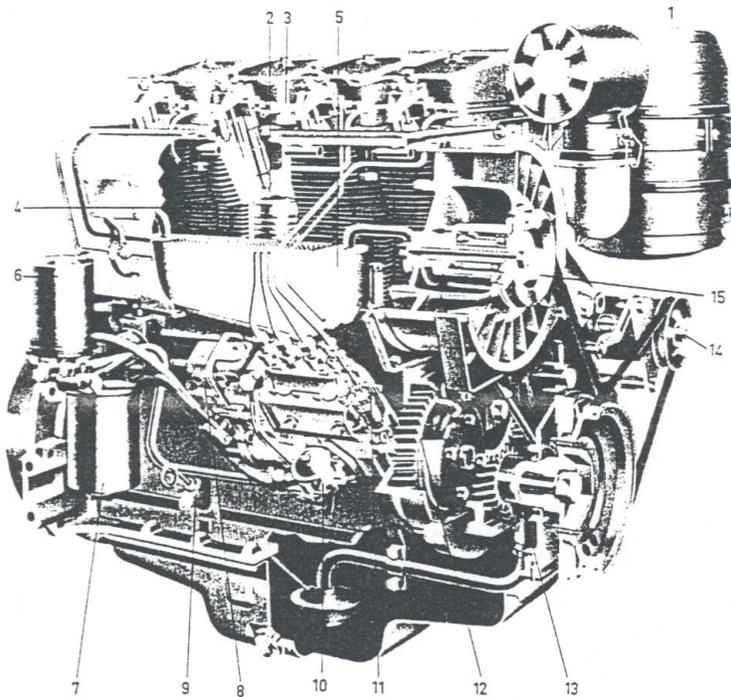
Cutaway View of Direct Injection F4L 912 Four Cylinder Engine



Exhaust Side

- 1 cooling fan
- 2 cooling fins
- 3 piston and (direct injection type) combustion chamber
- 4 light metal cylinder head and inlet/outlet valve assy.
- 5 rocker arm
- 6 induction manifold
- 7 exhaust manifold
- 8 pushrod and duct assy.
- 9 camshaft
- 10 flywheel and ring gear assy.
- 11 crankshaft and counterweight assy.
- 12 sump
- 13 lube oil pump
- 14 timing gear train
- 15 cooling fan

Service Side



- 1 oil bath type air cleaner and preliminary filter assy.
- 2 injectors
- 3 cylinder head cover
- 4 finned cylinder barrel
- 5 block-type oil cooler
- 6 fuel filter
- 7 lube oil filter
- 8 governor and speed control lever assy.
- 9 dipstick
- 10 fuel lift pump
- 11 fuel injection pump
- 12 timing gear train
- 13 lube oil pump
- 14 dynamo/alternator
- 15 cooling fan

MECHANISM OF FUEL CONTAMINATION AND QUALITY ON EMISSIONS

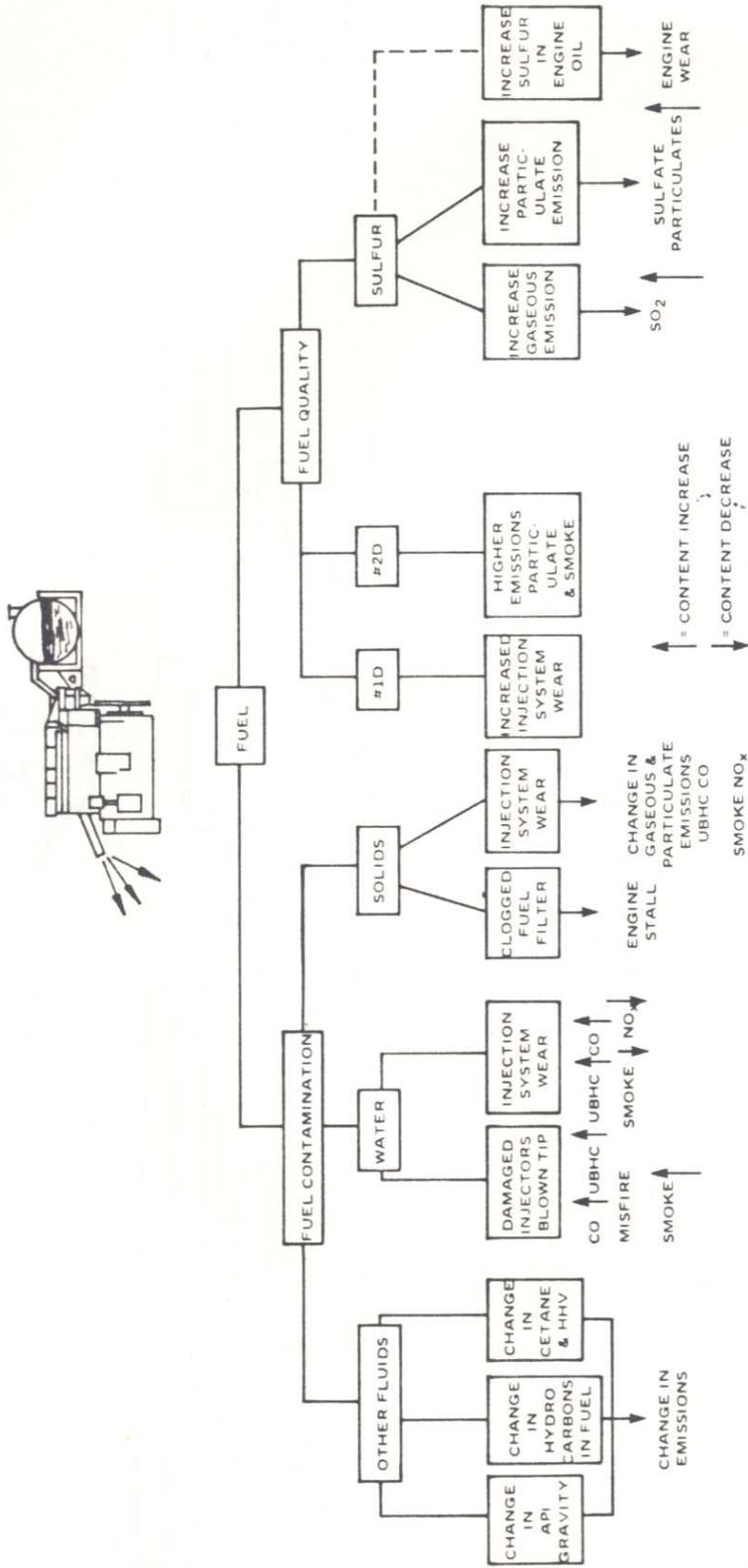
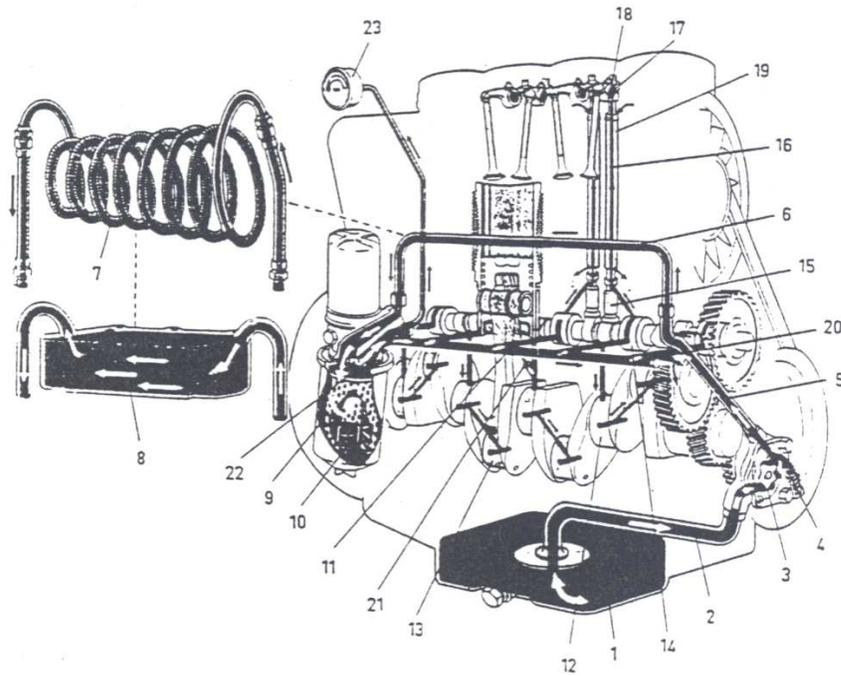


FIGURE C-28. RELATIONSHIP OF FUEL CONTAMINATION TO EMISSIONS

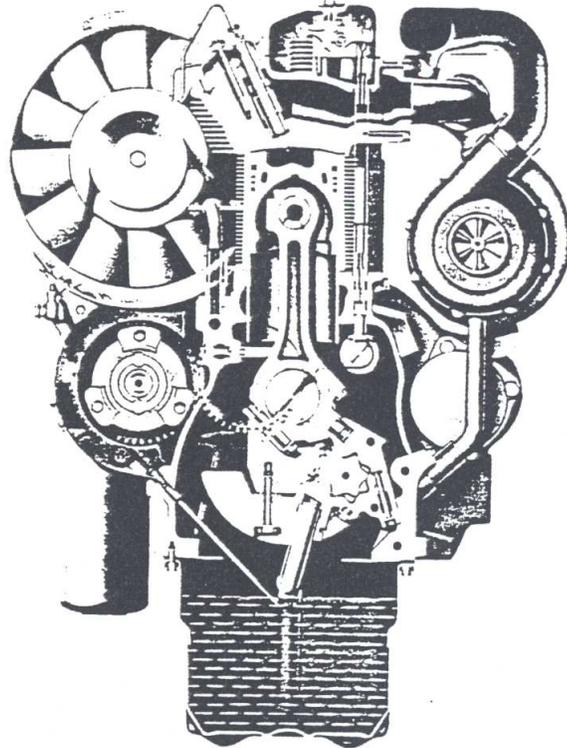
ENGINE FUNDAMENTALS



Lube Oil System

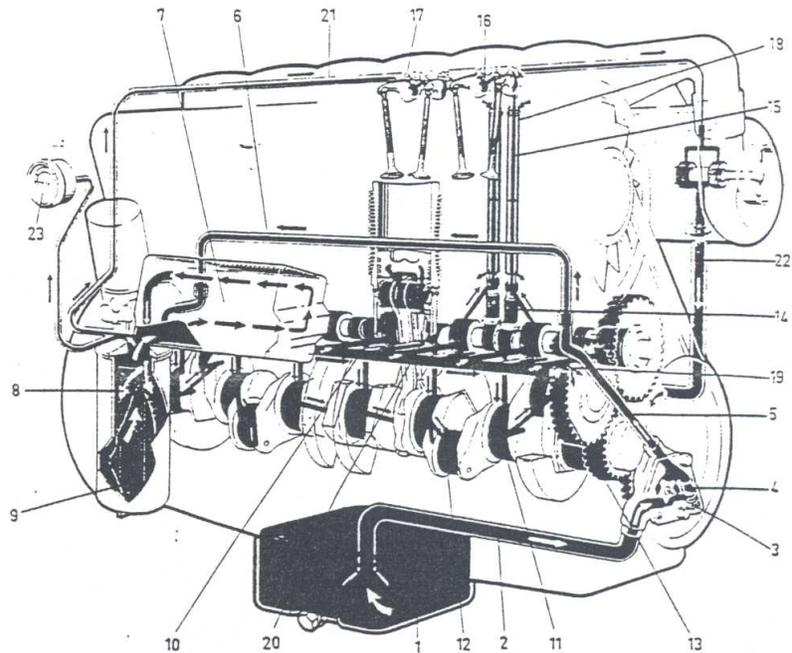
- | | |
|---|-------------------------------|
| 1 sump | 21 piston cooling nozzle |
| 2 suction pipe | 22 oil pressure gauge adaptor |
| 3 lube oil pump | 23 oil pressure gauge |
| 4 oil pressure control valve | |
| 5 pressure pipe | |
| 6 by-pass pipe or alternative | |
| 7 cooling coil or alternatively: | |
| 8 block-type oil cooler | |
| 9 oil filter | |
| 10 safety valve | |
| 11 main oil gallery | |
| 12 main bearing | |
| 13 big end bearing | |
| 14 camshaft bearing | |
| 15 tappet (with timing groove
to pulse-lubricate rocker arm | |
| 16 pushrod (hollow, used as
rocker arm oil feed pipe | |
| 17 rocker arm bearing | |
| 18 metering plug (to control
valve lubrication) | |
| 19 pushrod duct (used as
cylinder-head-to-crankcase
oil return pipe | |
| 20 splash hole to lubricate
timing gears | |

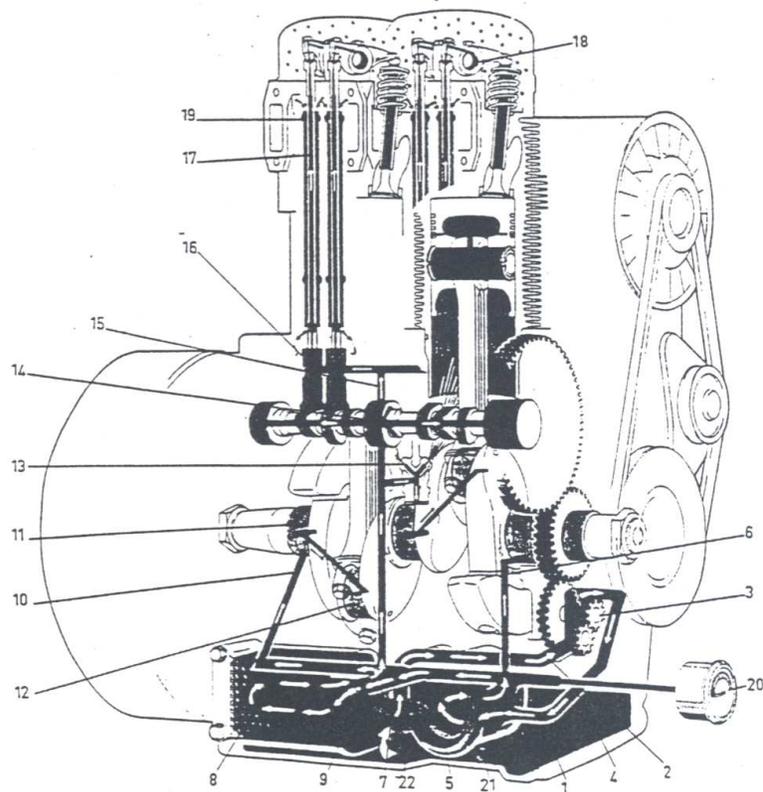
Sectional View of BF6L 913



BF6L 913 Lube Oil System

- 1 sump
- 2 suction pipe
- 3 oil pump
- 4 oil pressure control valve
- 5 pressure pipe
- 6 oil cooler connecting pipe (by-pass)
- 7 block-type oil cooler
- 8 oil filter safety valve
- 10 main oil gallery
- 11 main bearing
- 12 big end bearing
- 13 camshaft bearing
- 14 tappet (with timing groove to pulse-lubricate rocker arms)
- 15 pushrod (hollow, used as rocker arm oil feed pipe)
- 16 rocker arm bearings
- 17 metering plug (to control valve lubrication)
- 18 pushrod duct (used as cylinder-head-to-crankcase oil return pipe)
- 19 splash hole (for timing gear lubrication)
- 20 piston cooling spray nozzle
- 21 lube oil feed pipe for exhaust turbocharger
- 22 exhaust turbocharger-to-crankcase oil return pipe
- 23 oil pressure gauge





F2L 912/W Lube Oil System

- | | |
|--|--|
| <ul style="list-style-type: none"> 1 sump 2 suction pipe 3 lube oil pump 4 pressure pipe 5 oil filter and filter cartridge assy. (full-flow type) 6 no. 3 main bearing oil duct 7 oil cooler feed pipe 8 oil cooler (to suit engine version) 9 oil feed pipe for no. 2 main bearing, camshaft/timing gears and piston cooling device 10 oil duct for no. 1 main bearing 11 main bearing 12 big end bearing 13 piston cooling spray nozzle 14 camshaft bearing 15 tappet oil duct 16 tappet (with timing groove to pulse-lubricate rocker arm) 17 pushrod (hollow, used as rocker arm lube oil feed pipe) 18 rocker arm bearing | <ul style="list-style-type: none"> 19 push rod duct (used as cylinder-head-to-crankcase oil return pipe) 20 oil pressure gauge 21 oil filter housing drain plug 22 main drain plug |
|--|--|

Section 1

Basic Operation

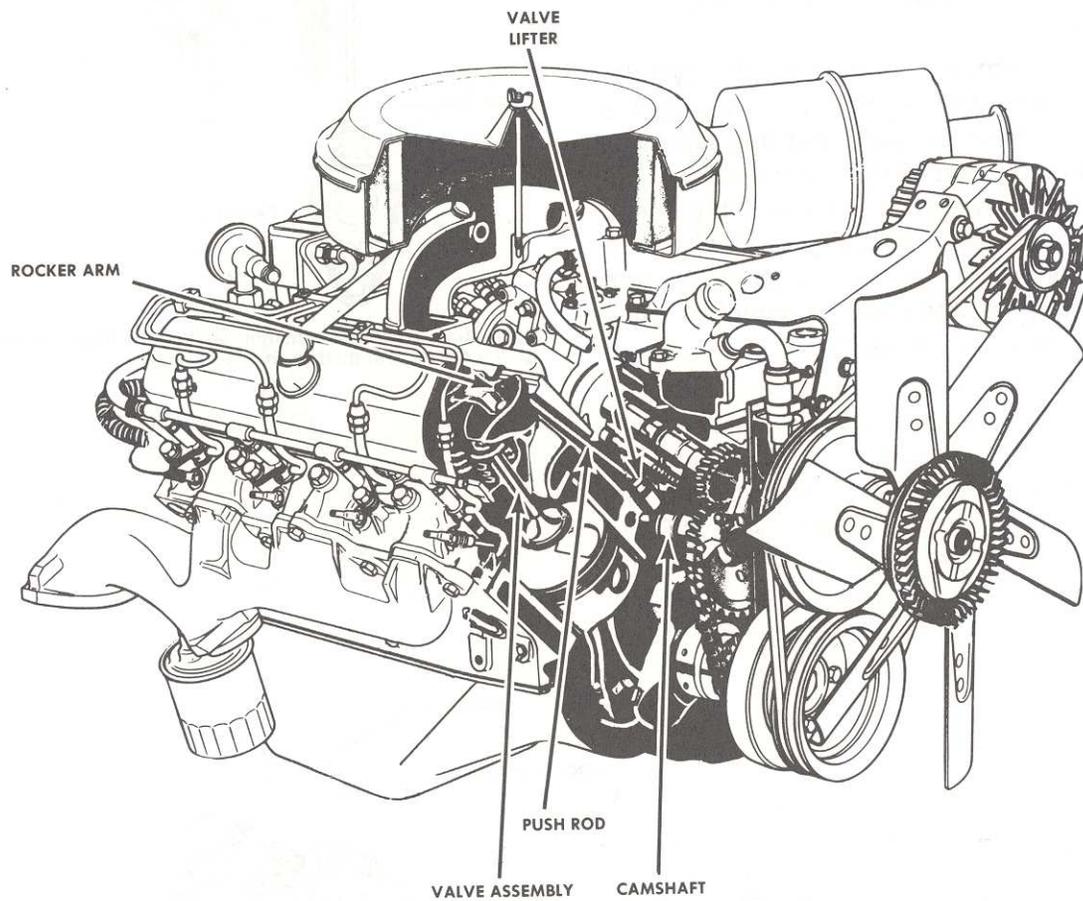


Figure 3-40. Typical valve train. (Cadillac)

Circle the answer that best completes each statement.

1. The difference between the operation of a diesel engine and a gasoline engine is that:
 - a. The gasoline engine relies on compression-generated temperature to initiate combustion, not an electrical spark.
 - b. The diesel engine relies on compression-generated temperature to initiate combustion, not an electrical spark.
 - c. The diesel engine only runs on a two-stroke cycle and the gasoline engine only runs on a four-stroke cycle.
 - d. The gasoline engine only runs on a two-stroke cycle and the diesel engine only runs on a four-stroke cycle.

2. Cummins engines are four-stroke diesel engines.
 - a. True
 - b. False

3. In what order does the four-stroke diesel engine cycle occur?
 - a. Intake, power, compression, exhaust
 - b. Power, intake, compression, exhaust
 - c. Compression, power, intake, exhaust
 - d. Intake, compression, power, exhaust

4. During the _____ stroke, the piston travels downward, causing air to enter the cylinder chamber through the valves.
 - a. Intake
 - b. Compression
 - c. Power
 - d. Exhaust

5. As the piston rises in the cylinder during the _____ stroke, the air is compressed and heated, and fuel is injected into the cylinder.
 - a. Intake
 - b. Compression
 - c. Power
 - d. Exhaust

6. During the _____ stroke, burning fuel increases the air temperature and cylinder chamber pressure, forcing the piston down and rotating the crankshaft.
- Intake
 - Compression
 - Power
 - Exhaust
7. During the _____ stroke, the piston travels upward in the cylinder, forcing gases out of the chamber through valves.
- Intake
 - Compression
 - Power
 - Exhaust
8. Diesel engine performance is measured by:
- Power per cylinder volume.
 - Torque rating at a specific number of revolutions per minute.
 - Horsepower at a specific RPM.
 - Both b and c.
9. _____ is a measure of the force of rotation of a driven shaft.
- Horsepower
 - Torque
 - Liters
 - Thrust
10. Horsepower is a unit of measure of _____.
- How much the engine weighs
 - How fast the vehicle travels
 - The engine performance
 - The number of cylinders in the engine

FUELS & EMISSIONS

DIESEL FUEL

Objectives:

In this chapter you will learn:

- Five differences between diesel fuel and gasoline.
- The effects of cold weather on diesel fuel.
- How cold weather's effects on diesel fuel are compensated.
- The difference between cetane and octane ratings.
- How ignition lag time is influenced by the cetane rating.
- Why diesel fuel and gasoline should never be mixed.
- Why a wound contaminated with fuel should be treated immediately.
- Five rules for storing diesel fuel.

Diesel Fuel Characteristics:

Diesel fuel, like gasoline, is made from petroleum. However, at the refinery, the petroleum is separated into three major components – gasoline, middle distillates, and all remaining substances.

Diesel fuel comes from the middle distillate group, which has properties and characteristics different from gasoline. Each of these characteristics will be discussed and contrasted with gasoline.

Heat Energy:

Diesel fuel contains more heat energy than gasoline. The heat energy or value is commonly measured in *British thermal units* (BTU). One BTU is the amount of heat energy needed to raise the temperature of one pound of water one degree Fahrenheit. (The metric equivalent of the BTU is the calorie. One calorie will raise gram of water one degree Celsius). The diesel engine converts the fuel's heat energy into power. If the fuel used has a high heat energy content, more heat energy will be released. Hence, if two engines are identical, each having the same thermal efficiency, but are fed two different fuels, the engine that receives the fuel containing the higher BTU content would be more economical. It would produce the same power using less fuel.

Specific Gravity:

The specific gravity of a liquid is a measurement of the liquid's weight compared to water. Water is assigned a value of one. Diesel fuel is lighter than water but heavier than gasoline and can change if it is mixed with other fuels. The specific gravity of diesel fuel is important to engine operation. The fuel must be heavy enough to achieve adequate penetration into the combustion chamber. If the specific gravity is too low, all the fuel immediately burns upon entering the combustion chamber. This puts all the force of combustion on one small area of the piston instead of equal force across the dome. As a result, performance suffers, engine noise increases, and the piston could eventually be damaged.

Wax Appearance Point and Pour Point:

Temperature affects diesel fuel more than it affects gasoline. This is because diesel fuels contain paraffin, a wax substance common among middle distillate fuels. As temperatures drop past a certain point, wax crystals begin to form in the fuel. The point where the wax crystals appear is the *wax appearance point* (WAP) or *cloud point*. WAP may change as a result of the origin of the crude oil and the quality of the fuel--the better the quality, the lower the WAP. As temperatures drop, the wax crystals grow larger and restrict the flow of fuel through the filters and lines. Eventually the fuel, which may still be a liquid, stops flowing because the wax crystals plug a filter or line. As the temperature continues to drop, the fuel reaches a point where it solidifies and no longer flows. This is called the pour point. In cold climates, it is recommended that a low-temperature pour point fuel be used.

Viscosity:

The viscosity of diesel fuel directly affects the spray pattern of the fuel into the combustion chamber and the fuel system components. Fuel with a high viscosity produces large droplets that are hard to burn. Fuel with a low viscosity sprays in a fine, easily burned mist. If the viscosity is too low, it does not adequately lubricate and cool the injection pump and nozzles.

Volatility:

Volatility is the ability of a liquid to change into a vapor. Gasoline is extremely volatile compared to diesel fuel. For instance, if diesel fuel and gasoline are exposed to the atmosphere at room temperature, the gasoline evaporates and the diesel fuel does not.

Flash Point:

Flash point is the lowest temperature at which the fuel burns when ignited by an external source. The flash point has little bearing on engine performance, but it is important in fuel storage safety. (The temperature at which the flash point occurs is regulated.) If the flash point of diesel fuel were lower than specified, it would have the right combination of air and fumes that would ignite too easily, making the handling of it hazardous. Gasoline evaporates at a very low temperature, filling the tank with fumes that are potentially explosive.

Cetane Rating:

The ignition quality of a fuel refers to how well it self-ignites under heat and pressure. Diesel fuel's ignition quality is measured by the cetane rating. To get a cetane number rating, a fuel is compared to cetane, a colorless, liquid hydrocarbon that has excellent ignition qualities. Cetane is rated at 100. The higher the cetane number, the shorter the ignition lag time (delay time) from the point the fuel enters the combustion chamber until it ignites. The exact rating is determined by mixing the cetane with a chemical called methyl-naphthalene, which is rated at zero since it does not ignite. The percentage of cetane mixed with methyl-naphthalene that produces a similar ignition quality to the fuel being tested is the cetane number rating. Ignition quality and flash point should not be confused.

Flash point is the lowest temperature at which the fuel burns when ignited by an external source.

The quality of gasoline is measured by octane, which indicates the resistance of a fuel to self-ignite (knock). Premium gasoline has poor ignition quality since it burns slower than regular gasoline and has more resistance to preignition and detonation. For automotive diesels, the recommended cetane rating is approximately 45.

Carbon Residue:

Carbon residue is the material left in the combustion chamber after burning. It is found not only in diesel engines but also in other engines that burn hydrocarbon fuel.

Sulfur Content:

Sulfur content is common in fuels made from low-quality crude oil. Refining the oil removes only a portion of the sulfur. Sulfur increases ring and cylinder wear, causing the formation of varnish on the piston skirts and sludge in the oil pan. Changing the oil frequently or switching fuels often helps prevent wear.

Fuels that have a high sulfur content are often high in various nitrogen compounds. These nitrogen compounds, like the sulfur, form corrosive chemicals causing excessive engine wear.

Water Content:

Water in diesel fuel is a major problem because water and diesel fuel readily mix. Careless storage and distribution of diesel fuel invites problems. Diesel fuel that appears cloudy often contains water. Some of the problems that water causes are:

1. Corrosion of the fuel system. This can cause the fuel filter to plug with rust particles.
2. Icing of the fuel system. Ice forms in areas where the water collects and the temperature is below freezing which may cause severe damage to the fuel system components.
3. Inadequate lubrication of the injection pump and nozzles. Water does not have good lubricating qualities.
4. Bacteria growth in diesel fuel.

Bacteria Content:

Diesel fuel is attacked by various fungi and bacteria. They ingest the diesel fuel as food, changing it to their waste products – a slimy, gelatin-type growth. This growth not only plugs the fuel system but also produces an acid that is corrosive to fuel system components. Because the fuel may contain harmful organisms, any that would be exposed to diesel fuel should be cleaned immediately. Fungicides and bactericides, which prevent their formation and growth, are available.

Commercial Fuel Ratings:

There are three grades of diesel fuel for automotive use: 1-D, 2-D, and 4-D. At one time, there was a grade 3-D, but it has been discontinued.

Grade 1-D is a kerosene-type fuel that has a lower viscosity, lower wax content, and lower BTU per gallon than grade 2-D. It is also more volatile than 2-D.

Grade 2-D is the fuel recommended for automotive and some industrial applications.

Grade 4-D is a fuel for low and medium speed engines.

Heating fuel, which is similar to grade 2-D fuel, should not be used in automotive applications. Heating fuel does not meet the strict standards or have the needed additives for automotive use.

Blended Fuel:

In cold climates, it is often necessary to run on a blended fuel. A blended fuel reduces the WAP and pour point, allowing the fuel to flow at low temperatures. Typically, grade 1-D fuel is used to lower the WAP and pour points of grade 2-D fuel. Each manufacturer has specific instructions on what blend should be used at certain temperatures. Usually, a 10% increase of grade 1-D to grade 2-D lowers the WAP by 2°F (1°C). However, since grade 1-D has a lower heat energy content, fuel economy also decreases.

Additives are chemicals added at the refinery to lower the WAP and pour point. At the refinery, the composition of the oil and wax content is known. The proper additives are blended with the fuel to give it the desired properties. Additives used in the after market by owners and technicians may or may not work because of variations in oil composition. Furthermore, use of additives may violate the manufacturer's warranty.

Fuel Storage:

Clean fuel for operating diesel engines is essential. Adequate containers are necessary to store fuel until it is used. Technicians who keep a small supply of diesel fuel on hand should be aware of a few facts:

1. Diesel fuel ages and will go stale. Keep a fresh supply available.
2. Variations in heat and humidity tend to create condensation in the fuel storage containers. Fuel containers should be kept where the temperature is relatively moderate and out of direct sunlight.
3. Never store diesel fuel in galvanized containers. Diesel fuel causes the galvanizing to flake off, contaminating the fuel system and clogging the fuel filters.
4. Containers should always be properly labeled and identified as containing diesel fuel.
5. Never add alcohol to diesel fuel. This lowers the flash point of the fuel.

Summary:

Diesel fuel has several characteristics different from gasoline. Diesel fuel has a higher heat content, specific gravity, and viscosity. Diesel fuel is more sensitive to cold weather. WAP (cloud point) is the temperature at which wax crystals appear. Pour point is the temperature at which diesel fuel solidifies and no longer flows. The cetane rating is the opposite of the octane rating. The higher the cetane number, the shorter the ignition delay times. Carbon residue is the material left after combustion. Small, high-speed diesels cannot tolerate excessive carbon deposits. Sulfur and nitrogen compounds create corrosive chemicals causing premature engine wear. Diesel fuel has an affinity for water. Care must be taken to keep the water content to a minimum.

Diesel fuels for automotive use come in three grades: 1-D, 2-D, and 4-D. Grade 2-D is the recommended fuel for diesel engines in cars and trucks under most conditions. It is often blended with grade 1-D to lower the WAP and pour point.

Gasoline should never be mixed with diesel fuels. The combination of the fuels can create a powerful bomb when ignited by a spark.

Diesel fuel must be stored properly to prevent stale fuel and water contamination. It should never be stored in a galvanized container and never mixed with alcohol. Fuel containers should be clearly marked and identified.

Fuels and Emissions

1. How does diesel fuel obtain a cetane number?
 - A. Diesel fuel is compared to octane.
 - B. Diesel fuel is compared to cetane.
2. Diesel fuel is separated into _____ components.
 - A. 2
 - B. 3
3. _____ is one of the most important systems on a diesel engine.
 - A. Injection system
 - B. Pressure system
4. Material left in the combustion chamber after burning is called:
 - A. Flash point
 - B. Carbon residue
5. The higher the cetane number, the shorter the ignition _____.
 - A. Delay time
 - B. Back pressure
6. There are _____ grades of diesel fuel.
 - A. 4
 - B. 3
7. The rate diesel fuel burns is measured in:
 - A. Volatility
 - B. Cetane
8. The ignition quality and manner in which diesel fuel burns is related to its:
 - A. Volatility
 - B. Cetane
9. The fuel for diesel engines of machines approved for service in underground mines shall:
 - A. Have no requirements on the sulfur content.
 - B. Contain sulfur in a concentration of .05 percent or less by weight unless a variance is granted by the Chief.
10. Diesel fuel must be stored properly to prevent:
 - A. Heat content
 - B. Water contamination
11. What grade of fuel do manufacturers recommend for diesel engines?
 - A. 4 D
 - B. 2 D

12. Which of the following diesel fuels has the highest cetane number?
 - A. 1D
 - B. 2D

13. Diesel fuel is obtained from:
 - A. Coke
 - B. Crude oil

14. The lowest temperature at which a fuel will ignite by an external source is defined as:
 - A. Viscosity
 - B. Cetane

15. Approximately what temperature is the air compressed before ignition occurs?
 - A. 7000 degrees
 - B. 1000 degrees

16. Heat energy or value is usually measured in:
 - A. Specific gravity
 - B. British Thermal Unit (BTU)

17. What is formed when diesel fuel is burned with a limited amount of air?
 - A. Carbon monoxide
 - B. Sulfur

18. What is formed when diesel fuel is burned with excess air?
 - A. Carbon dioxide
 - B. Sulfur dioxide

19. Sulfur content in diesel fuels can cause:
 - A. Wear on ring and cylinder
 - B. Wear on exhaust system

20. High sulfur content is common in fuels that are:
 - A. Made of high quality crude oil
 - B. Made of low quality crude oil

21. What is the rating of cetane?
 - A. 50
 - B. 100

22. Diesel fuel ignition quality is rated by:
 - A. Cetane
 - B. Octane

23. How well a fuel will self-ignite under heat and pressure is called:
 - A. Ignition quality
 - B. Flash point

24. Flash point is the lowest temperature at which a fuel burns when ignited by an:
- A. Internal source
 - B. External source
25. When enough oxygen is present to burn the fuel in the combustion chamber, hydrocarbons will be deposited as:
- A. White smoke
 - B. Soot
26. What will happen to the sulfur in diesel fuel after combustion?
- A. It will pass through as SO₂ emissions.
 - B. It will remain in the combustion chamber.
27. The characteristics of diesel fuel, thin when hot and thick when cold, is defined as:
- A. Volatility
 - B. Viscosity
28. What does viscosity mean?
- A. Resistance to flow
 - B. Greatest protection
29. The viscosity of diesel fuel directly affects the _____ of the fuel into the combustion chamber.
- A. Engine knock
 - B. Spray pattern
30. When fuel changes from a liquid to a vapor, it is called:
- A. Flash point
 - B. Volatility
31. _____ has the lowest volatility.
- A. Gasoline
 - B. Diesel fuel
32. A catalytic converter can remove up to _____ % of diesel exhaust hydrocarbons.
- A. 80%
 - B. 20%
33. The catalytic converter changes SO₂ to:
- A. SO₄
 - B. NO₂
34. What does the catalytic converter do to the engine exhaust emission?
- A. Helps the engine perform
 - B. Changes the emissions
35. The exhaust system on diesel-powered equipment shall be inspected:
- A. Once per day
 - B. Weekly

36. How many types of water bath scrubbers are used on diesel equipment?
A. 4
B. 2
37. State-of-the-art water scrubbers on diesel-powered equipment may capture up to _____% of exhaust hydrocarbons.

A. 10%
B. 20%
38. The main function of a water scrubber is to:
A. Lower exhaust temperature
B. Make smoke clean
39. A water scrubber must be equipped with:
A. High water shutdown
B. Low water shutdown
40. How often should water scrubbers on underground diesel equipment be cleaned?
A. Each day
B. Each week
41. The two primary functions of a water scrubber are:
A. Converter and catalyst
B. Spark or flame arrester and exhaust-gas cooling
42. Water scrubbers should be constructed of _____ for long life.
A. Copper
B. Stainless steel
43. Water scrubbers are designed to:
A. Keep the exhaust in water as long as possible to lower the temperature
B. Raise the exhaust emissions
44. How does diesel fuel react in cold weather?
A. Diesel fuel will get thicker as the temperature drops
B. Diesel fuel will get thinner as the temperature drops
45. Should gasoline be mixed with diesel fuel?
A. A 50/50 mixture is usually acceptable
B. No, never use gasoline in a diesel engine

Fuels & Emissions

1. B
2. B
3. A
4. B
5. A
6. B
7. B
8. A
9. B
10. B
11. B
12. A
13. B
14. C
15. B
16. B
17. A
18. A
19. A
20. B
21. B
22. A
23. A
24. B
25. B
26. A
27. B
28. A
29. B
30. B
31. B
32. A
33. A
34. B
35. A
36. B
37. B
38. A
39. B
40. A
41. B
42. B
43. A
44. A
45. B

PREVENTIVE MAINTENANCE

**DIESEL ENGINE
PREVENTIVE MAINTENANCE CHECKLIST**

MINE: _____

DATE: _____

PERSON PERFORMING CHECKS: _____

<u>Description of Task</u>	<u>Date Completed</u>
1. Drain air tank water	_____
2. Check fire extinguisher	_____
3. Change engine oil and filter	_____
4. Check fuel level	_____
5. Check brake shoes	_____
6. Check air filter indicator	_____
7. Grease driveline u-joints	_____
8. Check all hoses/gaskets for leaks	_____
9. Check fuel filler cap	_____
10. Check exhaust piping/manifold	_____
11. Check exhaust piping/manifold	_____
12. Check fan drive oil and filter	_____
13. Check air filter	_____
14. Check trans, oil, and filter	_____
15. Check final drive fluid level	_____
16. Check/drain fuel/water separator	_____
17. Check final drive oil hub seals	_____
18. Check battery electrolyte level	_____
19. Clean external engine components	_____
20. Clean transmission cooler	_____
21. Check/tighten belts	_____
22. Check fuel tank	_____
23. Clean filter bowl in engine blower	_____
24. Check engine components and machine for safe operating condition	_____

* The above list may not apply to all diesel-powered equipment.

PREVENTIVE MAINTENANCE

1. The most common additive to be mixed with water in the cooling system is:
 - A. Carbon tetrachloride
 - B. Ethylene glycol
2. Why should antifreeze be used in summertime?
 - A. To inhibit rust
 - B. Coolant is able to pump water with greater ease.
3. When water coolant system overheats, you should check:
 - A. Fan belt & cooling system level
 - B. Alternator & fuel pump
4. The coolant system should be checked on diesel-powered equipment:
 - A. Monthly
 - B. Daily
5. The main purpose of the radiator cap is to:
 - A. Raise the boiling point of the coolant.
 - B. Help keep coolant in the reservoir.
6. _____ circulates the water through a water cool engine.
 - A. Radiator
 - B. Coolant pump
7. _____ turns the fan on non-permissible diesel engine.
 - A. Coolant pump
 - B. Crankshaft
8. What is heat exchanger called on a diesel water cool engine?
 - A. Radiator
 - B. Impeller
9. What are water jackets on a diesel engine?
 - A. Water pump
 - B. Block of engine
10. The purpose of the coolant system on the diesel engine is to:
 - A. Cool the engine
 - B. Cool the transmission

11. Maintenance on the engine exhaust system will be done:
 - A. By a certified diesel engine mechanic
 - B. By the operator
12. If the exhaust system is off a diesel engine, it must be:
 - A. Fixed on the next shift
 - B. Fixed immediately
13. To ensure that the fuel supplied to the injector pump is clean, fuel filters must be replaced:
 - A. Monthly
 - B. At regular intervals
14. Regular oil & filter changes are very important to reduce engine wear on cylinder, piston, and _____.
 - A. Flywheel
 - B. Bearing
15. Fuel filters are rated in:
 - A. Microns
 - B. Particles
16. In case of fire, all underground diesel equipment must be equipped with _____.
 - A. 250 lb. of rock dust
 - B. Fire suppression system
17. Stationary diesel-powered equipment must be equipped with _____ dry chemical or carbon dioxide system or no less effective system approved by the Virginia Division of Mines.
 - A. A remote activated
 - B. An automatically activated
18. Nozzles and reservoirs of the fire protection system shall be placed in accordance with:
 - A. MSHA Approval & Certification Center.
 - B. Manufacturer's specifications to provide maximum protection to the fuel tank compartment, motor compartment, battery compartment, & hydraulic tanks.
19. The floor in the shop where diesel engines are to be repaired should be:
 - A. Free of grease and fuel
 - B. No requirements
20. Oily rags that have been used on diesel equipment shall be:
 - A. Kept in a box until removed
 - B. Kept in closed metal containers until removed for disposal
21. When the diesel engine is over heating the black smoke is coming out of the exhaust system, what is most likely the problem?
 - A. Too much oil
 - B. Air filter

22. The engine intake systems shall be inspected visually at least once each working:
 - A. Shift
 - B. Day

23. What is the intake system used for on a diesel engine?
 - A. To cool the engine
 - B. To clean the air before reaching the cylinder

24. The purpose of the lubrication system is to:
 - A. Allow combustion to take place when fuel mixes with oxygen
 - B. Distribute oil to key areas throughout the engine

25. A multi-viscosity oil can be thinner at lower temperatures to provide:
 - A. More horsepower
 - B. Easier starting

26. What two valves must be pushed to start a diesel engine using air start?
 - A. Starter and oil pressure override
 - B. Retry valve and lubricator

27. What should be done daily to the air system of diesel equipment?
 - A. Air starter should be checked.
 - B. Water should be drained from the air tank.

28. Air pressure in the safety system is set at:
 - A. 200 PSI
 - B. 50 PSI

29. Where is the main pressure gauge located on diesel machines equipped with an air system:
 - A. Operator's compartment
 - B. Engine compartment

30. Oil is used to reduce:
 - A. Horsepower output
 - B. Friction

Preventive Maintenance

1. B
2. A
3. A
4. B
5. A
6. B
7. B
8. A
9. B
10. A
11. A
12. B
13. B
14. B
15. A
16. B
17. B
18. B
19. A
20. B
21. B
22. B
23. B
24. B
25. B
26. A
27. B
28. B
29. A
30. B

PREVENTIVE MAINTENANCE

Cooling Systems

Cooling System Recommendations:

Engine cooling systems are relatively basic in design and function but are often neglected when it comes to routine maintenance. Scheduled maintenance programs should incorporate more checkpoints for engine cooling systems especially when it comes to cleaning. Dirt is the primary concern in keeping an engine cooling system running properly at a consistent temperature.

- Have a specified interval for cleaning radiators. This would depend on the location of the equipment, but at the very least, should be performed at the regular service intervals recommended by the engine manufacturer. This should be incorporated into the operator's education and included in his job description.
- A one-inch water hose and good commercial degreaser tend to work much better than a steam jenny or pressure washer.
- Use a light to verify that a radiator is cleaned completely through the core.
- Instrument the engine to measure differential temperature across the radiator. This gives an accurate indication of the performance of the cooling system. Measure the temperature across the inlet and outlet of the radiator while performing a stall test. The temperature should show a drop of 10°F or more.
- Thermostats should be checked on a regular basis to verify proper operation. Use the infrared heat gun to measure the temperature at which the thermostat opens. Point the gun at the thermostat housing and load the engine. When the thermostat opens, you will experience a quick temperature rise.
- Pressure test the cooling system on a scheduled basis and verify the correct mixture for engine coolant.
- Verify that the coolant storage system is clean and mixing is being done consistently and carefully.
- Deutz air-cooled engines **MUST** be cleaned at every scheduled maintenance interval. It is best to use a degreaser when doing this.
- On Deutz 413 series engines, blower speed should be checked regularly for possible slippage, as this is driven by oil pressure.
- Deutz engine oil coolers should also be cleaned regularly and checked with a light to verify.
- On all Deutz engines, verify that all gauge and alarm sensor wires are connected and in proper operating condition. Check for proper match of gauges to sensors.

Cooling System Maintenance Recommendations:

Daily maintenance performed by the operator:

- Check the coolant level in the top tank or header tank.
- Check and clean radiator core as necessary.

Monthly maintenance performed by the mechanic:

- Check the condition and tension of fan belts; adjust and replace as necessary.
- Check condition of inhibitors.
- Check coolant for proper freeze protection.
- Check the condition of gasket in radiator cap.

Yearly maintenance performed by the mechanic:

- Clean the cooling system relief valve.
- Drain, flush, and clean complete cooling system. Replace the new coolant mixture.
- Check the condition of all hoses and clamps; tighten and replace as necessary.

Coolant Mixture:

Water alone must NOT be used in a diesel cooling system. Both distilled and softened water are excessively corrosive and lack the proper heat transfer properties as well as freeze protection. It is important to have a consistent and accurate method of mixing coolant for proper protection.

The use of ethylene glycol type antifreeze solutions is highly recommended for coolant mixtures. A procedure for premixing and storage of coolant should be used. The solution should be mixed at a level to provide protection that exceeds the system requirements.

Conditioners and Inhibitors:

Conditioners such as Nalcool 3000 should be used on a scheduled basis. These products reduce the risk of rust and pitting to the cylinder liners, block, and head. They also reduce the buildup of scale and deposits in the cooling system. Most conditioners will provide protection for seals, hoses, gaskets, and metal materials in the cooling system.

Cleaning and Flushing:

The cooling system should be flushed and cleaned at least once a year and also whenever engine repairs dictate. An example of this would be a leaking oil cooler which resulted in oil contamination in the coolant. A simple dishwasher detergent such as Calgon mixed with water works very well in flushing the cooling system. Repeated flushes may be necessary to remove all dirt and oil contaminants from the system.

It is very important to make sure that the system is completely cleaned before adding new coolant and conditioners.

Troubleshooting:

The first steps in diagnosing an overheating condition are all visual checks. The easiest and most obvious checks are:

- Low coolant level
- Loss of coolant – external or internal leaks
- Clogged radiator – check using a light
- Low fan speed – check using a tach
- Fan condition and installation (pushing or pulling)
- Radiator cap seal

If visual diagnostics fail to solve the problem, there are some basic tests that can be performed to isolate individual cooling system components.

Thermostats:

The thermostats can be tested either in or out of the engine. To test the thermostat without removing it, measure the temperatures at both the top tank and stat housing. Observe the level and flow of coolant in the top tank and temperatures as the stat begins to open and circulate coolant through the radiator. This test is only accurate with engines using no more than one thermostat.

A more accurate test method is to remove the thermostat and suspend it in a metal container of water. Using an acetylene torch and thermometer, heat the water in the container and observe the opening temperature compared to the plug in the stat. It is important to note that an engine should NOT be run without the thermostats installed. Coolant does not flow properly through the radiator without the thermostat and results in increased overheating.

Aeration in Coolant:

The most common cause of aeration is combustion leaking into the coolant. The best way to test for this is to tap a hose from the radiator cap relief valve into a container of water. Bring the engine to full operating temperature and check for steady bubbles coming out of the end of the hose. Sources of combustion in the coolant can be leaking head gaskets, loose head, defective seal, etc.

Radiator Cap Relief Valve:

Cooling system pressure can be tested either with a hand pressure pump tool or air regulator and pressure gauge. Pressurize the system to a level just below relief pressure and observe how the system holds pressure.

Rapid leak down indicates either an external/internal leak or leaking relief valve. Pressurize the system higher to determine the relief opening pressure for proper setting.

Temperature Probe:

A portable infrared temperature probe is used by mechanics specifically for diagnosing cooling systems. This is a simple, hand-held instrument that measures surface temperature with a simple point and shoot operation. An LCD display on the instrument updates the value instantly or is capable of logging the value to memory. This is particularly effective in demonstrating and diagnosing cooling systems.

In seconds the efficiency of a radiator could be verified by measuring the differential temperature from top to bottom. Thermostat operation is easily verified by pointing at the thermostat housing and observing the temperature transition as the thermostat opened and closed.

Job Aid Checklist for Cooling System:

Diesel engines have a cooling system radiator mounted to the side or front of the engine. The cooling system should be checked for the following:

Checkpoints:

- Thermostat operation (I.R. temperature gun)
- Radiator cleanliness and flow-through pressure test
- Test strips for additive/inhibitor condition
- Fan and belt adjustment and condition

PREVENTIVE MAINTENANCE

Intake

Intake System:

Introduction:

The intake system on a diesel engine must provide an adequate supply of clean air for good combustion at all operating speeds, loads, and operating conditions. As much as 1500 cubic feet of air per minute or more may be required. This depends on engine size and horsepower. On naturally aspirated (non-turbocharged) and turbocharged engines, air is as important to good operation as the quality of the fuel used. Lack of adequate airflow to an engine can result in high emissions along with poor performance.

Contaminated air can quickly wear out a diesel engine – a condition often referred to as “dusting”. This condition is particularly noticeable when an engine has been overhauled, and after a short period in service, compression and power losses are noticeable.

Tests conducted by major diesel engine manufacturers have shown that as little as two tablespoons of dirt can dust out an engine within a very short time. Unfiltered air contains small particles of dirt and abrasive material that are not always visible to the naked eye.

Intake air can also be contaminated by partially burned fuel. Some of it can wash down the cylinder wall and can dilute lubrication oil. Some of the unburned fuel dries up and sticks to pistons, rings, and valves as well as fouling up the small orifices in the injector tip, resulting in higher emissions. Nothing wears out a diesel engine faster than contaminated air entering the intake system. The dirt and oil mixture acts as an abrasive lapping compound. On the cylinder walls, it proves to be disastrous. Imagine how the continuous rubbing action of the piston rings against the liner surface contaminated with abrasive dirt in the oil quickly accelerates wear.

The air cleaner on diesel engines is designed to remove moisture, dirt, and dust from the air before it reaches the engine. It must do this over a reasonable time period before servicing is required. The air cleaner also acts as a silencer to reduce intake air noise. On a turbocharged engine, additional air is supplied by means of a turbocharger, which is exhaust gas-driven. On a supercharged engine (Detroit 2 cycle), a mechanically-driven blower is used to supply additional air. The filter sizing should take into consideration these two additional features. **(Always refer to the manufacturer’s recommended filter size for any given engine application.)**

Intake System Recommendations:

In a mining application the intake system becomes the most critical engine system affecting exhaust emissions. Problems associated with intake air are magnified in every other engine system's performance.

Some points worth considering in maintaining intake systems:

- The ducting and piping for the intake system should utilize two spring-loaded band clamps at each rubber hose connection.
- The entire system, ducting, filter housing, gaskets, etc., should be tested every 100 hours for integrity and leaks. The use of ether spray that was at one time common practice is not recommended under any circumstances due to danger of fire and explosion and possible engine damage. The best alternative is a compressed air charge system described in the next section.
- The location and installation of intake filter housings should be evaluated. Ideally they should be situated away from heat sources (exhaust) and dust sources (tires). They should also be installed to facilitate good serviceability.
- Every underground diesel engine should be equipped with a two-stage intake filter system with a radial type seal at the back of the filter for failsafe protection.
- Inspect intake filter system and verify that it is sized correctly to meet engine requirements. Refer to filter manufacturer's recommendations.
- Verify that ducting is of sufficient size without unnecessary restrictions.
- Ensure that intake filter housing is installed as close to the engine intake manifold as possible.
- On engines equipped with dual intake filters, ensure that there is a common connection to both housings to prevent balance problems such as turbo overspeed.
- Do not rely solely on intake restriction indicators located at the filter housing. Proper gauges should be installed at the operator dash. It is imperative that operators be educated on the use and importance of this.
- The mechanics should service intake systems at minimum intervals. This would be at least a weekly inspection and possible filter service, if required. Once again it is imperative that the operators be educated and empowered to monitor the intake system and make necessary service immediately on detection of a problem.

PREVENTIVE MAINTENANCE

Exhaust Systems

Exhaust System Introduction:

The exhaust system used on modern diesel engines must be laid out in such a manner that the maximum permissible exhaust backpressure never exceeds the manufacturer's recommendations. To test the backpressure in a typical diesel engine exhaust system, a slack-tube manometer can be used or a special low-pressure gauge. This is a low-pressure gauge designed especially for measuring intake and exhaust backpressure and restrictions on diesel engines.

The use of after treatment devices such as catalytic converters, flame arrestors, water scrubbers, and particulate traps tend to increase the engine exhaust backpressure. Excessive exhaust backpressure has a similar effect on engine performance and emissions as an increased intake restriction. Power output reduction, increased exhaust temperature, CO (Carbon Monoxide), black smoke, and particulate emissions all go up.

After treatment devices used on diesel engines can vary tremendously in size and design. The purpose, however, is the same. They allow the escaping exhaust gases, which are under pressure, to expand within the after treatment device, thereby reducing the noise emitted as they exit into the atmosphere.

In addition, some after treatment devices act as a secondary burner for any unburned hydrocarbons left over from the combustion process. Typical noise levels from heavy-duty diesel engines is usually within the 80 to 86 decibels after treatment devices are installed.

Improper maintenance could lead to plugging up or badly restricted exhaust system. The resulting flow restriction will exceed the backpressure limits set by the manufacturer.

An excessive exhaust backpressure has a similar effect on diesel engine performance and emissions, similar to increased intake restriction.

Exhaust System:

Exhaust System Recommendations:

Relatively minor and basic maintenance practices can have a large impact on emissions reduction. Monitoring the physical properties of exhaust such as gas concentrations, pressure, and temperature is absolutely essential to proper maintenance.

- Monitor exhaust backpressure at regular scheduled service intervals using one or a combination of mechanical gauges, or the UGAS analysis system. Backpressure is a prime indicator of how both the engine and exhaust systems are performing with respect to baseline values.
- Inspect the installation of exhaust after treatment systems. Verify that they are properly sized (not too small or too big) and that they come close enough to the exhaust manifold for maximum operating temperature.

- Establish a method of evaluating the condition and performance of after treatment devices. This can be done by measuring backpressure and gases with tools such as the UGAS system.
- Inspect the installation of the piping on the exhaust system. Look for dents, leaks, damage, and possible causes of restriction that could increase back pressure. When possible, use heat wrap for protection and also to maximize exhaust temperatures for after treatment performance.
- Inspect the condition of the turbocharger assembly. When inspecting the fins, make sure to look from the top inside and not from the end. Check the compressor wheel on the intake side for a sandblasted effect indicated by a smooth, worn down blade on the compressor wheel. After cooler pressure differential should be measured regularly to ensure proper cooling. Operators should be trained in the proper operation of turbo-equipped engines as to the start up and shut down procedures.

Exhaust After Treatment System Maintenance Recommendations:

Diesel Oxidation Catalysts (DOCs):

These devices are designed to convert carbon monoxide (CO) to carbon dioxide (CO₂). In addition, they also reduce hydrocarbons (HC) and the HC fraction of DPM. Diesel oxidation catalysts are very effective due to the excess oxygen present in diesel combustion and the reaction between the oxygen and the catalyst element.

In order for these systems to operate efficiently, they must work with exhaust temperatures in excess of 200°C. This requires that the installation of the system be such that the purifier is mounted as close as possible to the exhaust manifold for maximum temperature. It is also important to use low sulfur fuel with DOCs as the catalytic element can be poisoned and neutralized by excess sulfur. It should also be noted that DOCs do not reduce NO_x emissions.

Basic Emission Equipment Operation:

Undiluted Diesel Particulate Measurement:

In addition to diesel exhaust gases, which are easily measured, the particulates in diesel exhaust should also be measured. Unfortunately, accurate portable instruments for measuring diesel particulate in exhaust are not commercially available. Some technicians use opacity meters, but these are quite crude instruments.

CANMET has developed a simple, portable system for sampling undiluted particulate matter from production vehicles. The system includes a sampling probe, heated lines, a filter cassette, a constant flow pump, and a temperature sensor.

The stainless steel sampling probe is inserted in the exhaust pipe while the engine is running. The pump draws in exhaust air, which flows through a 15-foot heated line and through the

filter to capture the diesel particulates. The heat is provided by using power from the vehicle battery and prevents condensation in the sampling line. A high volume pump is calibrated to draw 12 liters per minute. The temperature sensor is a thermocouple from the ECOM analyzer, which records the temperature of the exhaust gas. The temperature of the air is also recorded.

The sampling is done over a 60-second steady state stall condition. Perform a steady state engine stall against the converter and hydraulics system -- brakes on, wheels chocked, unit in second gear, maximum throttle, along with hydraulic stall. Maximum stall time 60 seconds. Both gas and particulate samples can be taken simultaneously.

The diesel particulate is collected on a pre-weighed filter. After the sample collection, the filter is weighed again to get the total weight of the sample collected. The volume of exhaust gas passed through the filter is calculated by multiplying the pump flow rate and the sampling duration. The DPM concentration is obtained by dividing the weight of the particulate mass collected by the volume of exhaust gas passed through the filter.

Measurement Interpretation:

Note: The following is an excerpt from the actual testing performed during the development of the guidelines. It is not intended that the mechanics would be able to perform these evaluations. It is only included to give the mechanic an overview of the process.

Analysis of Particulate Samples:

Measurement and analysis of the particulate sample filters was done at the NRCan CANMET laboratories in Sudbury and Bells Corners, Ontario. Weight analysis for total mass was done at the Bells Corners facility and the analysis by NIOSH 5040 Thermal Optical method [4] was performed at the Sudbury laboratory.

Weight Analysis:

- Sample filters (silver membrane) were conditioned in an environment chamber for at least one hour at 45% RH \pm 8%, 22°C \pm 3°C.
- A Mettler 183 balance, accuracy 1g \pm 0.00001 g, was calibrated using internal calibration procedures.
- A blank filter pair was weighted for determining filter weight changes due to variations in conditions within the weighing chamber between initial and final sample weight determinations.
- Sample filters were weighed and placed in plastic sample holders, which were then capped.

- Upon the sample filter's return, filters were removed from plastic sample holders, placed in petrie dishes, covered, and conditioned in an environment chamber for at least one hour at 45% RH \pm 8%, 22°C \pm 3°C.
- The Mettler 183 balance was calibrated using internal calibration procedures.
- The blank filter pair was weighted.
- Sample filters were then weighted.
- DPM mass was determined by subtracting initial from the final sample weights, correcting each DPM for changes in blank filter weights. During the field-testing, three batches of sample cassettes were assembled with blanks and shipped to the mine. The numbered cassettes were stored in a locker in the underground shop and brought to the office on surface after sample capture.
- Cassettes including blanks were sent to the DCANMET laboratory in Bells Corners for analysis.

Thermal Optical Method:

In brief, NIOSH method 5040, speciation of organic and elemental carbon, is accomplished through temperature and atmosphere control, and by an optical feature that corrects for pyrolytically generated "EC" (or char) formed during the analysis of some materials (e.g., cigarette and wood smoke). A light from a pulsed diode laser is passed through the filter to allow continuous monitoring of filter transmittance. The analysis process is done in two stages.

In the first stage, organic carbon and carbonate carbon (if present) are volatilized from the sample in a pure helium atmosphere. The temperature is stepped to a maximum (about 860°C). Evolved carbon is catalytically oxidized to CO₂ in a bed of granular MnO₂, reduced to CH₄ in a Ni/firebrick methanator, and quantified as CH₄ by a flame ionization detector (FID).

During the second stage of the analysis, a pyrolysis correction (if needed) and EC measurement are made. The oven temperature is reduced, an oxygen (2%)-helium mix is introduced, and the oven temperature is again raised. As oxygen enters the oven, pyrolytically-generated EC is oxidized and concurrent increase in filter transmittance occurs. Correction value point defined as the "split" between organic and elemental carbon. Carbon evolved prior to the split is considered "organic" (including carbonate), and carbon after the split and prior to the peak used for instrument calibration (final peak) is considered "elemental".

The 5040 method was used to analyze the first set of samples that were taken on quartz fiber filters. This was done due to inconsistencies measuring total weight due to high humidity combined with quartz fiber filters. There were 21 samples in the first set analyzed with 5040 and quartz fiber filters. For correlation purposes and verification of accuracy, three samples with silver membrane filters were measured with 5040 and correlated to previous samples on the same vehicles with quartz fiber.

Job Aid Check List for Exhaust System Analysis Tools:

ECOM AC + Gas Analyzer:

The electro-chemical gas sensors used in the ECOM unit are recommended for calibration every six months. The analyzer for the project was purchased new from ECOM America and was delivered with all sensors calibrated. The calibration gases used are:

- Carbon Monoxide – 1000 ppm
- Nitrogen Oxide – 100 ppm
- Nitrogen Dioxide – 100 ppm
- Oxygen – Verified against O₂ concentration in NO or NO₂ cal gas

The ECOM analyzer incorporates a three-minute calibration each time the unit is started. All gas sensors are “zeroed” against the ambient air drawn through the probe for the three-minute period. For this reason it is critical that each time the analyzer is turned on the probe remains in as fresh an ambient environment as possible and no where near any running exhaust gases.

Particulate Sampling – Gilian Pump:

The undiluted particulate sampling system incorporated a Gilian high volume 30 LPM pump for drawing the exhaust through the 37 mm cassettes. Under ideal conditions this instrument would be calibrated for each sampling session. Calibration of this instrument might be beyond the scope of the mechanic’s expected work and therefore it may be necessary to have it performed by the ventilation department.

Intake Testing:

The intake system can easily be considered the most critical with respect to maintenance and emissions. Ironically the intake system has the least known tools for servicing. In the past, ether spray was used for detecting intake leaks by listening for engine acceleration where ether would leak into the intake and combustion chamber.

Problems with ether, including extreme flammability and potential catastrophic engine failure when improperly used, have led to the discontinuation of its use. This situation left a huge gap where the only activity associated with intake systems was the regular replacement of air filter elements and blind faith that this practice alone was sufficient.

A system for methodically testing intake systems with no risks to either the person doing the test or the engine can be prepared by any mechanic. The system is simply a used intake filter element sealed externally with duct tape, an air pressure regulator and hose assembly, and a spray bottle containing a mixture of soap and water. During service the plugged filter

element(s) is installed in the intake housing and the air pressure regulator is connected to a fitting on the intake. Compressed air is regulated inside the intake system to no more than 5 psi for safety reasons. Even with the leakage across valves and turbocharger, enough static pressure remains in the system to produce bubbles when the soap and water solution is sprayed on all hoses and connections.

Intake Restriction and Exhaust Backpressure:

A Magnehelic Gauge from Dwyer Instruments can be purchased with a range from 0 – 80 inches of water. The gauge is capable of differential pressure measurements and therefore has two fittings, one for pressure and the other for vacuum measurement. This makes it ideally suited for measuring intake vacuum restriction, which is normally in the range of 10 inches of water, as well as exhaust backpressure, typically around 20 inches of water. The gauge is marked on the back to show which side is used for vacuum measurement and which side is used for exhaust pressure measurement. In addition to the portable gauge for servicing, a replacement program should be initiated for the intake tell-tale service gauges that are currently in use. The original small plastic plunger units were found to be anywhere between ineffective to defective.

Most of the gauges are installed in locations that are not visible from the operator's compartment; so on the rare occasions that they were actually checked, they weren't being checked properly. A replacement indicator gauge will alleviate this. The gauge can be purchased from Donaldson, who manufactures the intake housing and filter systems. The gauge is a standard three-inch mechanical bourdon tube with an appropriate range and scale for the intake system. The plunger indicators should be replaced by the gauges and installed in appropriate locations within sight of the operator's compartment.

PREVENTIVE MAINTENANCE

Lubrication

Lubrication:

Lubrication Recommendations:

Engine lubrication requires more attention to handling than most people give it. It is not merely a matter of topping up oil levels or replacing oil and filters. Mechanics and operators both need to recognize lubrication as an important factor in engine maintenance.

Maintaining a proper oil level in the crankcase is essential to minimizing emissions. The practice of overfilling a crankcase at the start of a shift to compensate for leaks or oil consumption creates more problems than it solves, especially with respect to emissions.

While low level problems will obviously cause wear and eventual failure problems, overfilled oil will cause problems with excessive emissions.

- As with the fuel filters, price should not determine which engine oil filters are purchased. Whenever possible, OEM filters should be purchased for each type of engine.
- Inspect and evaluate the system for selection, storage, handling, and dispersing of lube oils from the bulk storage system right through to the use of portable containers in the field. Fill cans and nozzles should be checked regularly for cleanliness.
- Evaluate the system in place for monitoring oil contamination. Ensure that the information from the oil is being used effectively by the right people. Periodically the oils should be checked for reserve alkalinity and soot level to verify the interval baseline.
- When possible, install warning systems for engine oil lube temperature. Excessively high temperatures have a direct negative effect on lubricity and viscosity.
- Educate both operators and mechanics on the importance of maintaining and verifying CORRECT ENGINE OIL LEVELS in engines. Operators should be checking the oil at the beginning of their shift. Mechanics should ensure that the right dipstick is in use on each piece of equipment on their beat.
- Oil and fuel filters should NOT be pre-filled on a workbench before installation due to the possibility of unnecessary contamination.

Lubrication Classification:

Engine lube oils and their classifications are often disregarded or misunderstood. For mining diesels, only the oil meeting the engine manufacturer's specified API classification should be used. Failure to do so could result in violation of the CANMET or MSHA certification as well as engine warranty.

As technology advances, many new lubrication products become available, often for specialized applications. The American Petroleum Institute (API) has had a classification system in place since 1970 as a recognized standard for matching lubricants to proper applications.

- “S” or “Service” is the classification for gasoline engines.
 - “C” or “Commercial” is the classification for diesel engines.
 - The second letter in the classification designates the time frame.
-
- SA Formerly Utility Gasoline and Engine Service Pre – 1930’s
 - SB Minimum Gasoline Engine Service 1930
 - SC Gasoline Engine Warranty Maintenance Service 1964-1967
 - SD Gasoline Engine Warranty Maintenance Service 1968-1971
 - SE Gasoline Engine Warranty Maintenance Service 1972-1980
 - SF Gasoline Engine Warranty Maintenance Service 1980-1988
 - SG Gasoline Engine Warranty Maintenance Service 1989-1993
 - SH Gasoline Engine Warranty Maintenance Service 1994-1997
 - SJ Gasoline Engine Warranty Maintenance Service 1998-Present
-
- CA Light to moderate duty, high quality fuels MIL-L-2104A; 1954
 - CB Light to moderate duty, lower quality fuels 1955-1963; high sulfur fuel
 - CC Moderate to severe duty diesel and gasoline MIL-L-2104B; 1964
 - CD Severe Duty Diesel Cat certification req’s 1955
 - CD-2 Severe duty diesel service Cat/Mack/Cummins 1983 and high speed operation prior to 1980
 - CF-4 Severe duty direct injected diesel service Direct injection 4-stroke engines in high speed operation prior to 1990
 - CG-4 Severe duty diesel engine service High speed, 4-stroke engines since 1995
 - CH-4 Severe duty diesel engine service High speed, 4-stroke engines since 1998

PREVENTIVE MAINTENANCE

Good Housekeeping Practices

- A. Keep engines free of grease, oil, and dust.
- B. Fuel spilled shall be cleaned up immediately.
- C. Keep the fuel clean and free from contamination.
- D. Store oily rags in closed containers.
- E. Keep work area free of stumbling hazards.

Note: **Work Safe!!!**

EMISSION TESTING

Emission Testing

Undiluted exhaust emissions of diesel engines, to include each side of a dual exhaust system, on diesel-powered equipment used in underground coal mines shall be tested and evaluated weekly by an authorized person. The mine operator shall develop and implement effective written procedures for such testing and evaluation that shall include the following:

1. The method for which a repeatable load test is conducted that must include an engine RPM reading;
2. Sampling and analytical methods used to measure diesel engine emission concentrations;
3. Instrumentation and calibration of instrumentation capable of accurately detecting carbon monoxide in the expected concentrations;
4. The method of evaluation and interpretation of sampling results;
5. The concentration or changes in concentration of carbon monoxide that will indicate a change in engine performance and an action plan to address changes in performance. The operator will establish a baseline level of diesel exhaust emissions, subject to approval by the chief, based upon the MSHA engine approval data and the average of the first four undiluted exhaust emission tests required by this section. This plan will establish an action level not to exceed the lesser of two times the baseline or 2500 parts per million (ppm) of carbon monoxide. Should the action level be exceeded, the machine shall be removed from service and engine performance improved.
6. The maintenance of records necessary to track engine performance. These records shall be:
 - A. Recorded in a secure book that is not susceptible to alteration, or recorded electronically in a computer system that is secure and not susceptible to alteration; and
 - B. Retained at a surface location at the mine for at least one year and made available for inspection by interested persons.

Air Quality

- A. During on-shift examinations required by § 45.1-161.209 of the Code of Virginia, a mine foreman authorized by the operator shall determine the concentration of carbon monoxide (CO) and nitrogen dioxide (NO₂).
 1. In the return of each working section where diesel equipment is used inby the loading point at a location which represents the contribution of all diesel equipment on such section.
 2. At a point inby the last piece of diesel equipment on a longwall or shortwall when mining equipment is being installed or removed. This examination shall be made

at a time which represents the contribution of all diesel equipment used for this activity including the diesel equipment used to transport longwall or shortwall equipment to and from the section.

3. In any other area designated by the chief where diesel equipment is operated in a manner which can result in significant concentrations of diesel exhaust emissions.
4. The concentrations of carbon monoxide (CO) and nitrogen dioxide (NO₂) shall not exceed the following threshold limit values:

Threshold Limit Values (TLV)	
Carbon Monoxide (CO)	25 ppm
Nitrogen Dioxide (NO ₂)	3 ppm

B. Samples of CO and NO₂ shall be collected and analyzed:

1. By appropriate instrumentation that has been maintained and calibrated in accordance with the manufacturer's recommendations;
2. In a manner that makes the results available immediately to the person collecting the samples; and
3. During periods that are representative of conditions during normal operations.

C. The results of these tests shall be:

1. Recorded in a secure book that is not susceptible to alteration, or recorded electronically in a computer system that is secure and not subject to alteration; and
2. Retained at a surface location at the mine for at least one year and made available for inspection by interested persons.

GLOSSARY OF OCCUPATIONAL SAFETY AND HEALTH TERMS

- LEL:** Lower Explosive Limit. The minimum concentration at which a gas will explode. A common unit of measurement is a percent of the LEL.
- PPM:** Part Per Million. A common unit of measurement for toxic gases. This term literally means one part out of one million possible parts.
- PEL:** Permissible Exposure Limit. Level of gas in ppm, a worker can be exposed to 8 hours a day/40 hours a week for the rest of his life with no long-term health effects. This limit is established by OSHA.
- REL:** Recommended Exposure Limit. Term interchangeable with PEL. REL is a term established by NIOSH.
- TLV:** Threshold Limit Value. A term used by the ACGIH to signify limits in gas exposure. TLV is usually used as a prefix for TWS and STEL.
- TLV-TWA:** Time Weighted Average. The average amount of gas in ppm, a worker can be exposed to over a certain time period. This time is usually defined as 8 hours to represent a normal work day. TWA is a term established by the ACGIH.
- TLV-STEL:** Short Term Exposure Limit. The average amount of gas in ppm, a worker can be exposed to in a 15-minute period with no long-term health effects. This may occur 4 times a shift with one hour between 15-minute exposures. STEL is a term established by the ACGIH.
- IDLH:** Immediately Dangerous to Life and Health. The maximum concentration of gas in ppm from which a worker could escape within 30 minutes without experiencing any escape-impairing or irreversible health affects. IDLH is a term established by HIOSH.

Oxygen Levels

CONCENTRATION OF OXYGEN

EFFECTS

23.5% Volume	Maximum “Safe Level”; OSHA
23% and Above	Oxygen enriched, extreme fire hazard
21%	Oxygen Concentration of AIR (20.954)
19.5%	Minimum “Safe Level”; OSHA, NIOSH
17%	Impairment of judgment starts to be detected
16%	First signs of anoxia appears
16-12%	Breathing and pulse rate increase, muscular coordination is slightly impaired
14-10%	Consciousness continuous; emotional upsets, abnormal fatigue upon exertion, disturbed respiration
10-6%	Nausea and vomiting, inability to move freely, and loss of consciousness may occur
<6%	Convulsive movements and gasping respiration occurs; respiration stops and a few minutes later heart action ceases

WEIGHTS OF VARIOUS GASES COMPARED TO AIR

The following gases are lighter than air:

Acetylene
*Ammonia
*Carbon Monoxide
Ethylene
Hydrogen
*Hydrogen Cyanide
Methane

The following gases are heavier than air:

Argon
Butane
Carbon Dioxide
*Chlorine
Ethane
Hexane
Hydrogen Chloride
*Hydrogen Sulfide
Methyl Ethyl Ketone
Methyl Mercaptan
*Nitrogen Dioxide
*Nitrous Oxide
Oxygen
Propane
*Sulfur Dioxide

Note: All gases marked by an * are toxic gases detected by our instruments.

GASES FOUND IN THE MINE ATMOSPHERE

1. **Carbon Dioxide** – Carbon Dioxide (CO₂) is a gas that occurs in normal air at a concentration of about 300 ppm. In mines where diesels are used, this can be expected to increase to 700 ppm of carbon dioxide. However, this gas is not toxic to human beings. Its danger lies in the fact that it can exclude oxygen under certain conditions. With adequate ventilation, carbon dioxide will not normally be of concern in the coal mine atmosphere.
2. **Carbon Monoxide** – Carbon Monoxide (CO) is a gas that properly invokes respect from all that know its properties. It possesses an extremely high affinity for the hemoglobin in the bloodstream and can thus asphyxiate a human being rather quickly if it gets into the human lungs by cutting off the oxygen to the brain and other body organs. Because it is also odorless, diligence in preventing its occurrence in the mine atmosphere is imperative. All internal combustion engines generate certain amounts of CO due to the inability to achieve complete combustion. Fortunately, diesel engines generate rather small amounts of carbon monoxide and careful control of oxygen/fuel ratio and mixing in combustion chamber(s) can keep CO under control. While the time-weighted average exposure limit for CO is not 50 ppm, Table 1 shows that normal exposure is about 10 ppm. Thus, while carbon monoxide is quite toxic, there appears to be no serious threat to health if the current biomedical information is correct.
3. **Nitric Oxide** --Nitric Oxide (NO) is a gas that has similar properties to CO. It causes a chemical asphyxiation of a human being because of its attack upon the oxygen delivery system of the body. Because of its high toxicity, it has been assigned a time-weighted average exposure limit of 25 ppm. Both explosives and diesels can produce NO in a coal mine; but because explosives are not widely used at present, diesel engines will normally be the most important source. NO levels of about 1 to 5 ppm seem to be normal concentrations found in diesel coal mines. As a result, the health ramifications may be of minor concern in most coal operations.
4. **Nitrous Dioxide** – Nitrous Dioxide (NO₂) is a gas generated by diesels that can cause pulmonary edema if present in sufficiently high concentrations. The effects can be delayed so that the lungs fill with fluid several days after exposure. Nitrous oxide is a reactive gas that rather quickly combines with water vapor, the mine surfaces, machine surfaces, and with particles in the air. Diesel coal mine concentrations of this gas are normally well below the threshold limit values of 36 to 84 ppm.
5. **Sulfur Dioxide and Other Sulfur Oxides** – Sulfur Dioxide (SO₂) and other sulfur oxides often designated (SO_x) are common gaseous products caused by the combustion of fuels containing sulfur. These gases are known to cause pulmonary irritation resulting in bronchial constriction and other dysfunction of the pulmonary system. The gases are produced in diesel engines but are not normally in sufficiently high concentrations to cause any problems. In addition, the trend now is toward lower sulfur contents in diesel fuel by choice and this will further reduce the problem in the future.

6. **Sulfuric Acid** – Sulfuric Acid (H_2SO_4) is normally produced along with the other sulfur compounds. The levels of this chemical are usually low but are increased when using a catalytic converter as they are produced during catalysis. The normal levels of this chemical are not considered to be a threat.
7. **Hydrocarbons** – A number of gaseous hydrocarbons exist in coal seams and are released at the time of mining. Methane is the primary gas so released, but some mines will have minor amounts of other gaseous hydrocarbons. These gases are of importance primarily because they are explosive when present in sufficient quantities but may be of only minor importance when considering health effects.

Benzene is one of the hydrocarbons found in trace amounts in the average diesel exhaust. Its concentration in the mine atmosphere is normally about 0.1 ppm where diesels are used. This is considerably less than the threshold limit value of 10 ppm set by ACGIH some time ago. However, ACGIH has now changed its designation of benzene from a suspected human carcinogen to a known human carcinogen (Anon., 1990). Thus benzene may become more of concern in the future.

8. **Heteroatomic Organics** – This category of organic chemicals includes oxygenated compounds, nitrogen compounds, and sulfur compounds (Anon., 1978).

EXHAUST EMISSIONS AND EMISSIONS TESTING

1. The chemical symbol for carbon monoxide is?
 - A. CO₂
 - B. C
 - C. CO
 - D. None of the above
2. TLV is an abbreviation for?
 - A. Threshold Limit
 - B. Threshold Limit Value
 - C. Neither A or B
3. The TLV for CO is?
 - A. 50 ppm
 - B. 25 ppm
 - C. 3 ppm
 - D. 1 ppm
4. The quantity of ventilating air reaching the LOC must be?
 - A. 9,000 cfm
 - B. 27,000 cfm
 - C. 100% of the name plate requirement
 - D. 6,000 cfm
5. The primary exhaust emission on an efficient, well maintained diesel engine is?
 - A. CO
 - B. NO
 - C. NO₂
 - D. CO₂
6. The chemical symbol for nitrogen dioxide is?
 - A. NO
 - B. N
 - C. NO₂
 - D. NAACL
7. Hydrocarbon emissions are a result of?
 - A. Complete combustion
 - B. Unburned fuel
 - C. High carbon content in the fuel
 - D. Heat

8. NO₂ emissions occur when?
- A. The nitrogen content of the air is high
 - B. In the presence of high heat
 - C. When the engine is cold
 - D. None of the above
9. Exhaust emissions from diesel engines used in underground coal mine, must be sampled as?
- A. A raw gas
 - B. In the exhaust pipe
 - C. Near the exhaust port as possible
 - D. All of the above
10. Emissions sampling equipment used by the mine operator to test underground diesels must?
- A. Be properly calibrated
 - B. Give an instant result
 - C. Be used in accordance with a written plan developed by the mine operator
 - D. All of the above
11. Diesel equipment that is used in or inby the LOC requires sampling:
- A. Each shift
 - B. Each day
 - C. Two times per shift at no more than 4 hour intervals
 - D. Weekly
12. The location of the sampling referred to in questions #11 is:
- A. The main return
 - B. At the vehicle
 - C. In the immediate return
 - D. On the intake side of the section
13. The emissions required to be sampled where diesel face equipment is operated are:
- A. CO and CO₂
 - B. NO and NO₂
 - C. NO and CO
 - D. CO and NO₂
14. The results of the emissions referred to in questions #13 must be recorded:
- A. In the pre-shift report
 - B. In the on-shift record
 - C. In the fire drill record
 - D. In the diesel examination record

**EXHAUST EMISSIONS AND EMISSIONS TESTING
ANSWER SHEET**

- 1. C**
- 2. B**
- 3. B**
- 4. C**
- 5. D**
- 6. C**
- 7. B**
- 8. B**
- 9. D**
- 10. D**
- 11. C**
- 12. C**
- 13. D**
- 14. B**



DIESEL EQUIPMENT APPROVAL FORM

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINES
PO DRAWER 900
BIG STONE GAP, VIRGINIA 24219
(540) 523-8100

Company Name:			Mine Name or Number:		Report Date	Mine Index Number:
Address:			Location:			MSHA ID Number:
City:	State:	ZIP:	County:	Office Phone Number:	Mine Phone Number:	
Person with Overall Responsibility:				Person in Charge of Health and Safety:		

Equipment #: _____
Manufacturer: _____
Type: _____
MSHA Permissible Approval No.: _____ **Power Package Approval No.:** _____
Model No.: _____ **Serial No.:** _____

Engine

Manufacturer: _____ **MSHA Cert. Approval No.:** _____
Model No.: _____ **Serial No.:** _____
Number of Cylinders: _____ **Horsepower (HP):** _____
Ventilation Rate: _____

Exhaust Treatment:

<input type="checkbox"/> Catalytic Converter	<input type="checkbox"/> Oxidation Catalytic Converter
<input type="checkbox"/> Diffuser	<input type="checkbox"/> Particulate Filter
<input type="checkbox"/> Scrubber	<input type="checkbox"/> Other _____

Diesel Equipment Approval

- Evaluation of undiluted exhaust emissions
- CO PPM _____ RPM _____
- Approved plan for stationary diesel-powered equipment
- Approved plan for diesel-powered portable generator

Operation of Diesel Equipment

- Free of accumulations of coal dust, oil, grease, fuel and other combustible materials
- Audible warning device
- Engine start and stop mechanism
- Guards over moving components
- Re-railing device (self-propelled rail equipment only)
- Sanding devices (self-propelled rail equipment only)
- Headlights on each end
- Park and Service brakes
- Fire suppression system
- Intake and exhaust couplings in good condition
- Self-closing filler cap on fuel tank
- Trolley wire minimum clearance 6 inches or adequately insulated
- Engine shall not start unless transmission in neutral

Permissible Equipment

- Electrical component permissibility maintained
- Emergency engine shutdown operable
- Flame arrestors (intake and exhaust) provided
- Low-level shutdown (water bath/scrubber) operable

Maintenance of Diesel Equipment

- Hour meter reading: _____
- Certified diesel mechanic
- Maintenance manuals available for review
- Record keeping process established

Ventilation of Diesel Equipment

- Evaluation of the adequacy of ventilation

Emission testing and evaluation

- Written procedures for weekly evaluation and test to include
 - Repeatable load test method
 - Sampling and analytical method to measure undiluted exhaust
 - Instrumentation calibration
 - Evaluation and interpretation of sampling results
 - MSHA Engine Approval Data
- CO PPM: _____ RPM: _____

Fire protection for diesel-powered equipment

- Mobile diesel-powered equipment fire suppression system
- Nozzles and reservoirs placed to provide maximum protection to the fuel tank compartment, battery compartment and hydraulic tanks
- Stationary diesel-powered equipment system AUTOMATIC fire suppression system

Fuel specifications

Statement from diesel fuel supplier
Date: _____ Sulfur Content: _____ Flash Point: _____ ° F

Comments:

Date Approved: _____

Inspector/Specialist: _____

DIESEL EQUIPMENT CHECK LIST

GENERAL

- | | | |
|--------------------------|--|--|
| <input type="checkbox"/> | ACCUMULATION OF COAL DUST, OIL, GREASE OR FUEL | SECTION 45.1-161.235C |
| <input type="checkbox"/> | AUDIBLE WARNING DEVICE | SECTION 45.1-161.141C |
| <input type="checkbox"/> | ENGINE START/STOP MECHANISM | SECTION 45.1-161.140 |
| <input type="checkbox"/> | GUARDS | SECTION 45.1-161.124 |
| <input type="checkbox"/> | LIFTING JACK (rail equipment only) | SECTION 45.1-161.141B |
| <input type="checkbox"/> | LIGHTS | SECTION 45.1-161.141C |
| <input type="checkbox"/> | PARK AND SERVICE BRAKES | SECTION 45.1-161.140 |
| <input type="checkbox"/> | SANDING DEVICES (rail equipment only) | SECTION 45.1-161.140 |
| <input type="checkbox"/> | FIRE SUPPRESSION SYSTEM | SECTION 480-05-9.2, PART III, 3.1, 3.2 |
| <input type="checkbox"/> | FUEL ADJUSTMENT PUMP SEALS | SECTION 480-05-9.2, PART 1, 1.5; 30 CFR 32.9(B) (2) (II) |
|
 | | |
| <input type="checkbox"/> | ENGINE START WITH TRANSMISSION CONTROLS IN NEUTRAL | SECTION 480-05-9.2 PART 1,1.10 |
| <input type="checkbox"/> | INTAKE AND EXHAUST COUPLINGS | 30 CFR, 32.4 (e), 36.23 (a) AND 36.25 (a) |
| <input type="checkbox"/> | METAL FUEL TANK WITH CLOSURE SECURED TO TANK | 30 CFR, 32.4 (g), 36.27 (a) |

PERMISSIBLE EQUIPMENT

- | | | |
|--------------------------|--|---------------------------------|
| <input type="checkbox"/> | ELECTRICAL COMPONENT PERMISSIBILITY | 30 CFR, 36.32 (a) AND (b) |
| <input type="checkbox"/> | EMERGENCY ENGINE SHUTDOWN | 30 CFR, 36.23 (c) |
| <input type="checkbox"/> | FLAME ARRESTORS (Intake and Exhaust) | 30 CFR, 36.23 (b) AND 36.25 (b) |
| <input type="checkbox"/> | LOW-LEVEL SHUTDOWN (Water Bath/Scrubber) | 30 CFR, 36.25 (b) AND (c) |
| <input type="checkbox"/> | SELF-CLOSING FUEL CAP | 30 CFR, 36.27 (a) |

CONDITIONS

- | | | |
|--------------------------|---|--|
| <input type="checkbox"/> | A diesel-powered equipment plan has been submitted to the Virginia Division of Mines in accordance with Section 480-05-9.2, Part 1, 1.1C | |
|
 | | |
| <input type="checkbox"/> | Proper instrumentation is available at the mine site to perform required air quality test in accordance with Section 480-05-9.2, Part II, 2.13. | |
|
 | | |
| <input type="checkbox"/> | A record keeping process has been established at this mine in accordance with Section 480-05-9.2, Part II, 2.14 and Part IV, 4.2 C. | |
|
 | | |
| <input type="checkbox"/> | Maintenance manuals are available for review in accordance with Section 480-05-9.2, Part IV, 4.4. | |

COMMENTS

INSPECTOR/SPECIALIST _____

DIESEL EQUIPMENT CHECK LIST

GENERAL

- | | | |
|--------------------------|--|--|
| <input type="checkbox"/> | ACCUMULATION OF COAL DUST, OIL, GREASE OR FUEL | SECTION 45.1-161.235C |
| <input type="checkbox"/> | AUDIBLE WARNING DEVICE | SECTION 45.1-161.141C |
| <input type="checkbox"/> | ENGINE START/STOP MECHANISM | SECTION 45.1-161.140 |
| <input type="checkbox"/> | GUARDS | SECTION 45.1-161.124 |
| <input type="checkbox"/> | LIFTING JACK (rail equipment only) | SECTION 45.1-161.141B |
| <input type="checkbox"/> | LIGHTS | SECTION 45.1-161.141C |
| <input type="checkbox"/> | PARK AND SERVICE BRAKES | SECTION 45.1-161.140 |
| <input type="checkbox"/> | SANDING DEVICES (rail equipment only) | SECTION 45.1-161.140 |
| <input type="checkbox"/> | FIRE SUPPRESSION SYSTEM | SECTION 480-05-9.2, PART III, 3.1, 3.2 |
| <input type="checkbox"/> | FUEL ADJUSTMENT PUMP SEALS | SECTION 480-05-9.2, PART 1, 1.5; 30 CFR 32.9(B) (2) (II) |
|
 | | |
| <input type="checkbox"/> | ENGINE START WITH TRANSMISSION CONTROLS IN NEUTRAL | SECTION 480-05-9.2 PART 1,1.10 |
| <input type="checkbox"/> | INTAKE AND EXHAUST COUPLINGS | 30 CFR, 32.4 (e), 36.23 (a) AND 36.25 (a) |
| <input type="checkbox"/> | METAL FUEL TANK WITH CLOSURE SECURED TO TANK | 30 CFR, 32.4 (g), 36.27 (a) |

PERMISSIBLE EQUIPMENT

- | | | |
|--------------------------|--|---------------------------------|
| <input type="checkbox"/> | ELECTRICAL COMPONENT PERMISSIBILITY | 30 CFR, 36.32 (a) AND (b) |
| <input type="checkbox"/> | EMERGENCY ENGINE SHUTDOWN | 30 CFR, 36.23 (c) |
| <input type="checkbox"/> | FLAME ARRESTORS Intake and Exhaust) | 30 CFR, 36.23 (b) AND 36.25 (b) |
| <input type="checkbox"/> | LOW-LEVEL SHUTDOWN (Water Bath/Scrubber) | 30 CFR, 36.25 (b) AND (c) |
| <input type="checkbox"/> | SELF-CLOSING FUEL CAP | 30 CFR, 36.27 (a) |

CONDITIONS

- A diesel powered equipment plan has been submitted to the Virginia Division of Mines in accordance with Section 480-05-9.2, Part 1, 1.1C

- Proper instrumentation is available at the mine site to perform required air quality test in accordance with Section 480-05-9.2, Part II, 2.13.

- A record keeping process has been established at this mine in accordance with Section 480-05-9.2, Part II, 2.14 and Part IV, 4.2 C.

- Maintenance manuals are available for review in accordance with Section 480-05-9.2, Part IV, 4.4.

COMMENTS

INSPECTOR/SPECIALIST _____

VIRGINIA DIESEL EQUIPMENT REGULATIONS

Diesel Equipment Regulations

480-05-9.2 Regulations Governing the Use of Diesel-Powered Equipment in Underground Coal Mines

4 VAC 25-90-20 Diesel equipment approval

- A. Diesel-powered equipment will not be permitted underground without receiving approval from the chief or his designated representative. Approval will be based on:
 - 1. Meeting the requirements of this regulation.
 - 2. Compliance with 30 CFR Part 7 Subpart E, design and performance requirements for nonpermissible diesel-powered equipment.
 - 3. An evaluation by the Division of Mines of the equipment, undiluted exhaust emissions, the adequacy of ventilation, and fire protection.
 - 4. If an oxidation catalytic converter, a diesel particulate filter, or both, are installed on underground diesel-powered equipment, they shall be installed and maintained in accordance with manufacturer's specifications.

- B. If at any time the Chief determines that any condition or practice permitted under this approval may threaten the health or safety of the employees, he may impose additional requirements for the purpose of eliminating the condition or practice.

- C. Stationary diesel-powered equipment, portable diesel generators, diesel-powered ambulances, and diesel fire fighting equipment shall not be permitted underground without an approved plan. The plan shall address ventilation, fire protection, fuel handling, storage, and any other requirements the chief determines as necessary to protect the health and safety of miners.

- D. The Division of Mines shall be notified after completion of any alterations in design, substitution of components, and any other changes in the condition of operating diesel-powered equipment that affects emissions. Additional engine testing and adjustments shall be required as necessary should any resulting changes be made that may increase diesel emissions.

4 VAC 25-90-30 Operation of diesel equipment

- A. All mobile underground diesel-powered equipment shall be operated safely and shall meet the following requirements:
 - 1. Be free of excess accumulation of coal dust, oil, grease, fuel and other combustible materials; and
 - 2. Be operated with:
 - a. An audible warning device;
 - b. An engine start and stop mechanism;

- c. Guards over moving components;
- d. A proper lifting device for the rerailling of such equipment (self-propelled rail equipment only);
- e. Sanding devices, except for personnel carriers that transport not more than five personnel (self-propelled rail equipment only);
- f. Headlights on each end;
- g. Park and service brakes;
- h. A fire suppression system;
- i. Intake and exhaust systems in good condition; and
- j. A self-closing filler cap on the fuel tank.

To avoid contact with energized trolley wires or trolley feeder wires, a six-inch minimum clearance shall be maintained or the equipment shall be adequately insulated.

- B. All mobile diesel-powered equipment operated in or inby the last open crosscut or in return air courses shall be permissible. Such diesel-powered equipment shall be maintained and operated in accordance with 4 VAC 25-90-20 and as follows:
 - 1. Electrical component permissibility shall be maintained;
 - 2. Emergency engine shutdown shall be operable;
 - 3. Flame arresters (intake and exhaust) shall be provided; and
 - 4. Low-level shutdown (water bath/scrubber) shall be operable.
- C. The engine of mobile diesel-powered equipment shall not be idling unattended.
- D. The engine of any mobile diesel-powered equipment shall not be capable of starting unless the transmission controls are in the neutral position.
- E. The operation of any diesel-powered equipment in any manner or under any condition that does not comply with the requirements of this chapter shall result in a notice of violation and, if not corrected within a reasonable time, a closure order shall be issued that requires the machine to be taken out of service until such condition or practice is corrected. Upon review of the history of violations, the chief may void the approval for use of underground diesel-powered equipment at that mine.

4 VAC 25-90-40 Maintenance of diesel equipment

- A. Engine intake and exhaust systems shall be inspected visually by an authorized person at least once each day that the equipment is operated.
- B. Permissible and emission components of diesel-powered equipment shall be inspected weekly by a certified diesel engine mechanic in accordance with the instructions of the manufacturer and all applicable federal and state requirements.
- C. All filters on diesel engines shall be maintained or replaced as recommended by the manufacturer or more often if necessary.
- D. Maintenance and repair work on emission components shall be done by a certified diesel engine mechanic in accordance with the instructions of the manufacturer and all applicable federal and state requirements.

- E. All diesel-powered equipment shall be equipped with an hour meter to accurately display engine run time.
- F. Maintenance manuals shall be made available for review by interested persons.
- G. Records shall be kept of inspections, maintenance, and repair work for at least one year and shall be made available for inspection by interested persons.

4 VAC 25-90-50 Ventilation of diesel equipment

- A. The ventilating air in all active areas where diesel-powered equipment is operated shall not have combustible or other contaminating gases in such concentration that may affect combustion in the diesel engine by materially increasing toxic, poisonous or other objectionable constituents in the engine exhaust.
- B. The air supplied for ventilation where diesel-powered equipment is used shall contain less than 1.0% by volume of methane.
- C. The minimum ventilating air quantity maintained in the last open crosscut of each working section where units of diesel-powered equipment are operated must be at least the sum of that specified on the approval plates of all the diesel-powered equipment to be operated in these areas.
- D. The minimum ventilating air quantity maintained in the intake reaching the working face of each longwall and at the intake end of any pillar line where units of diesel-powered equipment are operated on the working section must be at least the sum of that specified on the approval plates of all the diesel-powered equipment to be operated in these areas.
- E. The minimum ventilating air quantity for an individual unit of diesel-powered equipment being operated outby the working section shall be at least that specified on the approval plate for that equipment. Such air quantity shall be maintained:
 - 1. In any entry where the equipment is being operated in areas of the mine developed on or after July 18, 2001;
 - 2. In any air course with single or multiple entries where the equipment is being operated in areas of the mine developed prior to July 18, 2001; and
 - 3. At any other location as the chief may require.
- F. The quantity of ventilating air supplied to the active areas where diesel-powered equipment is operated must be adequate to dilute and carry away constituents of the engine exhaust so that the composition of the air meets the air quality standards set forth in 4VAC25-90-70.

4 VAC 25-90-60 Emission testing and evaluation

Undiluted exhaust emissions of diesel engines, to include each side of a dual exhaust system, on diesel-powered equipment used in underground coal mines shall be tested and evaluated weekly by an authorized person. The mine operator shall develop and implement effective written procedures for such testing and evaluation that shall include the following:

1. The method for which a repeatable load test is conducted that must include an engine RPM reading;
2. Sampling and analytical methods used to measure diesel engine emission concentrations;
3. Instrumentation and calibration of instrumentation capable of accurately detecting carbon monoxide in the expected concentrations;
4. The method of evaluation and interpretation of sampling results;
5. The concentration or changes in concentration of carbon monoxide that will indicate a change in engine performance and an action plan to address changes in performance. The operator will establish a baseline level of diesel exhaust emissions, subject to approval by the chief based upon the MSHA engine approval data and the average of the first four undiluted exhaust emission tests required by this section. This plan will establish an action level not to exceed the lesser of two times the baseline or 2500 parts per million (ppm) of carbon monoxide. Should the action level be exceeded, the machine shall be removed from service and engine performance improved.
6. The maintenance of records necessary to track engine performance. These records shall be:
 - a. Recorded in a secure book that is not susceptible to alteration, or recorded electronically in a computer system that is secure and not susceptible to alteration; and
 - b. Retained at a surface location at the mine for at least one year and made available for inspection by interested persons.

4 VAC 25-90-70 Air quality

- A. During on-shift examinations required by §45.1-161.209 of the Code of Virginia, a mine foreman authorized by the operator shall determine the concentration of carbon monoxide (CO) and nitrogen dioxide (NO₂).
 1. In the return of each working section where diesel equipment is used inby the loading point at a location which represents the contribution of all diesel equipment on such section.
 2. At a point inby the last piece of diesel equipment on a longwall or shortwall when mining equipment is being installed or removed. This examination shall be made at a time which represents the contribution of all diesel equipment used for this activity including the diesel equipment used to transport longwall or shortwall equipment to and from the section.
 3. In any other area designated by the chief where diesel equipment is operated in a manner which can result in significant concentrations of diesel exhaust emissions.
 4. The concentrations of carbon monoxide (CO) and nitrogen dioxide (NO₂) shall not exceed the following threshold limit values:

Threshold Limit Values (TLV)	
Carbon Monoxide (CO)	25 ppm
Nitrogen Dioxide (NO ₂)	3 ppm

- B. Samples of CO and NO₂ shall be collected and analyzed:
1. By appropriate instrumentation that has been maintained and calibrated in accordance with the manufacturer's recommendations;
 2. In a manner that makes the results available immediately to the person collecting the samples; and
 3. During periods that are representative of conditions during normal operations.
- D. The results of these tests shall be:
1. Recorded in a secure book that is not susceptible to alteration, or recorded electronically in a computer system that is secure and not subject to alteration; and
 2. Retained at a surface location at the mine for at least one year and made available for inspection by interested persons.

4 VAC 25-90-80 Fire protection for diesel-powered equipment

- A. Mobile, diesel-powered equipment shall have a multipurpose dry chemical type (ABC) fire suppression system or equivalent approved system.
- B. Nozzles and reservoirs shall be placed in accordance with the manufacturer's specifications to provide maximum protection to the fuel tank compartment, motor compartment, battery compartment and hydraulic tanks.
- C. Stationary diesel-powered equipment must be equipped with an automatic multipurpose dry chemical type (ABC) or equivalent approved fire suppression system.

4 VAC 25-90-90 Fuel specifications

- A. The fuel for diesel-powered equipment approved for service in underground mines shall be low volatile hydrocarbon fuel with a flash point of 100°F or greater at standard temperature and pressure, and shall contain sulfur in a concentration of .05% or less by weight.
- B. The mine operator shall maintain on the mine site and make available for inspection a statement from the diesel fuel supplier certifying the sulfur content and flash point of the diesel fuel to be used underground. This statement shall be updated annually and whenever the fuel distributor is changed.

4 VAC 25-90-100 Fuel use, storage, and handling

- A. Unless otherwise approved, fuel taken underground shall be transported in metal containers that have self-closing devices.
- B. Fuel taken underground and awaiting transfer to diesel-powered equipment fuel tanks shall be stored in a closed compartment or container constructed of incombustible material and shall be kept in a well-ventilated location until placed in the fuel tank.
- C. Fuel shall be transferred from the storage compartment to a fuel tank through a flexible hose that is fitted with a self-closing valve. This does not apply to portable containers of five gallons or less.
- D. The fuel handling system and the diesel-powered equipment shall be frame grounded so that a difference in potential does not exist when fuel is being transferred from the storage compartment to the fuel tank. This does not apply to portable containers of five gallons or less.
- E. The air vents on fuel handling equipment shall be flameproof. This does not apply to portable containers of five gallons or less.
- F. When fuel is being transferred from a storage compartment to the diesel equipment fuel tank, the engine shall be stopped.
- G. A supply of sand or other suitable incombustible material for absorbing spilled fuel shall be available during the transfer of fuel from a storage compartment to the diesel equipment fuel tank. Fuel spilled shall be cleaned up immediately.
- H. In order to prevent unintentional opening, all drain plugs in the fuel handling system shall be threaded, sealed, locked, and protected in the closed position.
- I. During fuel handling operations, precautions shall be taken to keep the fuel clean and free from contamination by foreign material such as dirt, sediment, and water.
- J. Diesel fuel storage and handling in a working section shall comply with the following:
 - 1. Underground storage areas that exceed 100 gallons shall be vented with intake air that is coursed into a return air course or to the surface and not used to ventilate working places.
 - 2. At least one, 20-pound approved ABC type fire extinguisher and no less than 200 pounds of rock dust per 100 gallons of fuel storage shall be maintained at the designated underground mine storage area.
 - 3. Only one temporary underground diesel fuel storage area is permitted for each working section or in each area of the mine where equipment is being installed or removed. Temporary storage areas must be located within 500 feet of the current loading point, the projected loading point where equipment is being installed, or the last loading point where equipment is being removed.
- K. Temporary and permanent underground diesel fuel storage facilities must be:

1. At least 100 feet from shafts, slopes, shops, or explosive magazines;
2. At least 25 feet from trolley wires, power cables, or electrical equipment not necessary for the operation of the storage facilities or areas; and
3. In a location protected from hazards of other mobile equipment.

Storage underground shall be limited to a typical 48-hour supply not to exceed 1,000 gallons.

November 3, 1997

**MINE SAFETY & HEALTH
ADMINISTRATION
DIESEL REGULATIONS**

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Subpart E --Diesel Engines Intended for Use in Underground Coal Mines

30 CFR § 7.82

Definitions.

In addition to subpart A definitions of this part, the following definitions apply in this subpart.

Brake Power. The observed power measured at the crankshaft or its equivalent when the engine is equipped only with standard auxiliaries necessary for its operation on the test bed.

Category A engines. Diesel engines intended for use in areas of underground coal mines where permissible electric equipment is required.

Category B engines. Diesel engines intended for use in areas of underground coal mines where nonpermissible electric equipment is allowed.

Corrosion-resistant material. Material that has at least the corrosion-resistant properties of type 304 stainless steel.

Diesel engine. Any compression ignition internal combustion engine using the basic diesel cycle where combustion results from the spraying of fuel into air heated by compression.

Exhaust emission. Any substance emitted to the atmosphere from the exhaust port of the combustion chamber of a diesel engine.

Intermediate speed. Maximum torque speed if it occurs between 60 percent and 75 percent of rated speed. If the maximum torque speed is less than 60 percent of rated speed, then the intermediate speed shall be 60 percent of the rated speed. If the maximum torque speed is greater than 75 percent of the rated speed, then the intermediate speed shall be 75 percent of rated speed.

Low idle speed. The minimum no load speed as specified by the engine manufacturer.

Maximum torque speed. The speed at which an engine develops maximum torque.

Operational range. All speed and load (including percent loads) combinations from the rated speed to the minimum permitted engine speed at full load as specified by the engine manufacturer.

Particulates. Any material collected on a specified filter medium after diluting exhaust gases with clean, filtered air at a temperature of less than or equal to 125°F (52°C), as measured at a point immediately upstream of the primary filter. This is primarily carbon, condensed hydrocarbons, sulfates, and associated water.

Percent load. The fraction of the maximum available torque at an engine speed.

Rated horsepower. The nominal brake power output of a diesel engine as specified by the engine manufacturer with a specified production tolerance. For laboratory test purposes, the fuel pump

calibration for the rated horsepower must be set between the nominal and the maximum fuel tolerance specification.

Rated speed. Speed at which the rated power is delivered, as specified by the engine manufacturer.

Steady-state condition. Diesel engine operating condition which is at a constant speed and load and at stabilized temperatures and pressures.

Total oxides of nitrogen. The sum total of the measured parts per millions (ppm) of nitric oxide (NO) plus the measured ppm of nitrogen dioxide (NO²).

30 CFR § 7.83

Application requirements.

(a) An application for approval of a diesel engine shall contain sufficient information to document compliance with the technical requirements of this subpart and specify whether the application is for a category A engine or category B engine.

(b) The application shall include the following engine specifications—

- (1) Model number;
- (2) Number of cylinders, cylinder bore diameter, piston stroke, engine displacement;
- (3) Maximum recommended air inlet restriction and exhaust backpressure;
- (4) Rated speed(s), rated horsepower(s) at rated speed(s), maximum torque speed, maximum rated torque, high idle, minimum permitted engine speed at full load, low idle;
- (5) Fuel consumption at rated horsepower(s) and at the maximum rated torque;
- (6) Fuel injection timing; and
- (7) Performance specifications of turbocharger, if applicable.

(c) The application shall include dimensional drawings (including tolerances) of the following components specifying all details affecting the technical requirements of this subpart. Composite drawings specifying the required construction details may be submitted instead of individual drawings of the following components:

- (1) Cylinder head
- (2) Piston
- (3) Inlet valve
- (4) Exhaust valve
- (5) Cam shaft--profile
- (6) Fuel cam shaft, if applicable
- (7) Injector body
- (8) Injector nozzle
- (9) Injection fuel pump
- (10) Governor
- (11) Turbocharger, if applicable
- (12) Aftercooler, if applicable
- (13) Valve guide
- (14) Cylinder head gasket
- (15) Precombustion chamber, if applicable

- (d) The application shall include a drawing showing the general arrangement of the engine.
- (e) All drawings shall be titled, dated, numbered, and include the latest revision number.
- (f) When all necessary testing has been completed, the following information shall be submitted:
 - (1) The gaseous ventilation rate for the rated speed and horsepower.
 - (2) The particulate index for the rated speed and horsepower.
 - (3) A fuel deration chart for altitudes for each rated speed and horsepower.

30 CFR § 7.84

Technical requirements.

- (a) Fuel injection adjustment. The fuel injection system of the engine shall be constructed so that the quantity of fuel injected can be controlled at a desired maximum value. This adjustment shall be changeable only after breaking a seal or by altering the design.
- (b) Maximum fuel-air ratio. At the maximum fuel-air ratio determined by [Sec. 7.87](#) of this part, the concentrations (by volume, dry basis) of carbon monoxide (CO) and oxides of nitrogen (NO^X) in the undiluted exhaust gas shall not exceed the following:
 - (1) There shall be no more than 0.30 percent CO and no more than 0.20 percent NO^X for category A engines.
 - (2) There shall be no more than 0.25 percent CO and no more than 0.20 percent NO^X for category B engines.

- (c) Gaseous emissions ventilation rate. Ventilation rates necessary to dilute gaseous exhaust emissions to the following values shall be determined under [Sec. 7.88](#) of this part:

Carbon dioxide.....	-5000 ppm
Carbon monoxide.....	-50 ppm
Nitric oxide.....	-25 ppm
Nitrogen dioxide.....	-5 ppm

A gaseous ventilation rate shall be determined for each requested speed and horsepower rating as described in [Sec. 7.88\(b\)](#) of this part.

- (d) Fuel deration. The fuel rates specified in the fuel deration chart shall be based on the tests conducted under paragraphs (b) and (c) of this section and shall ensure that the maximum fuel:air (f/a) ratio determined under paragraph (b) of this section is not exceeded at the altitudes specified in the fuel deration chart.
- (e) Particulate index. For each rated speed and horsepower requested, the particulate index necessary to dilute the exhaust particulate emissions to 1 mg/m³ shall be determined under [Sec. 7.89](#) of this part.

Subpart F --Diesel Power Packages Intended for Use in Areas of Underground Coal Mines Where Permissible Electric Equipment Is Required

30 CFR § 7.95

Purpose and effective date.

Part 7, subpart A general provisions, apply to subpart F. Subpart F establishes the specific requirements for MSHA approval of diesel power packages intended for use in approved equipment in areas of underground coal mines where electric equipment is required to be permissible. It is effective November 25, 1996.

30 CFR § 7.96

Definitions.

In addition to the definitions in subparts A and E of this part, the following definitions apply in this subpart.

Cylindrical joint. A joint comprised of two contiguous, concentric, cylindrical surfaces.

Diesel power package. A diesel engine with an intake system, exhaust system, and a safety shutdown system installed.

Dry exhaust conditioner. An exhaust conditioner that cools the exhaust gas without direct contact with water.

Exhaust conditioner. An enclosure, containing a cooling system, through which the exhaust gases pass.

Exhaust system. A system connected to the outlet of the diesel engine which includes, but is not limited to, the exhaust manifold, the exhaust pipe, the exhaust conditioner, the exhaust flame arrester, and any adapters between the exhaust manifold and exhaust flame arrester.

Fastening. A bolt, screw, or stud used to secure adjoining parts to prevent the escape of flame from the diesel power package.

Flame arrester. A device so constructed that flame or sparks from the diesel engine cannot propagate an explosion of a flammable mixture through it.

Flame arresting path (explosion-proof joint). Two or more adjoining or adjacent surfaces between which the escape of flame is prevented.

Flammable mixture. A mixture of methane or natural gas with normal air that will propagate flame or explode when ignited.

Grade. The slope of an incline expressed as a percent.

High idle speed. The maximum no load speed specified by the engine manufacturer.

Intake system. A system connected to the inlet of the diesel engine which includes, but is not limited to, the intake manifold, the intake flame arrester, the emergency intake air shutoff device, the air cleaner, and all piping and adapters between the intake manifold and air cleaner.

Plane joint. A joint comprised of two adjoining surfaces in parallel planes.

Safety shutdown system. A system which, in response to signals from various safety sensors, recognizes the existence of a potential hazardous condition and automatically shuts off the fuel supply to the engine.

Step (rabbet) joint. A joint comprised of two adjoining surfaces with a change or changes in direction between its inner and outer edges. A step joint may be composed of a cylindrical portion and a plane portion or of two or more plane portions.

Threaded joint. A joint consisting of a male- and female-threaded member, both of which are the same type and gauge.

Wet exhaust conditioner. An exhaust conditioner that cools the exhaust gas through direct contact with water, commonly called a water scrubber.

30 CFR § 7.98

Technical requirements.

(a) The diesel power package shall use a category A diesel engine approved under subpart E of this part with the following additional requirements:

- (1) A hydraulic, pneumatic, or other mechanically actuated starting mechanism. Other means of starting shall be evaluated in accordance with the provisions of [Sec. 7.107](#).
- (2) If an air compressor is provided, the intake air line shall be connected to the engine intake system between the air cleaner and the flame arrester. If the air compressor's inlet air line is not connected to the engine's intake system, it shall have an integral air filter.

(b) The temperature of any external surface of the diesel power package shall not exceed 302°F (150°C).

- (1) Diesel power package designs using water jacketing to meet this requirement shall be tested in accordance with [Sec. 7.101](#).
- (2) Diesel power packages using other techniques will be evaluated under the provisions of [Sec. 7.107](#).
- (3) When using water-jacketed components, provisions shall be made for positive circulation of coolant, venting of the system to prevent the accumulation of air pockets, and effective activation of the safety shutdown system before the temperature of the coolant in the jackets exceeds the manufacturer's specifications or 212°F (100°C), whichever is lower.

(c) External rotating parts shall not be constructed of aluminum alloys containing more than 0.6 percent magnesium.

- (d) If nonmetallic rotating parts are used, they shall be provided with a means to prevent an accumulation of static electricity. Static conducting materials shall have a total resistance of 1 megohm or less, measured with an applied potential of 500 volts or more. Static conducting materials having a total resistance greater than 1 megohm will be evaluated under the provisions of [Sec. 7.107](#).
- (e) All V-belts shall be static conducting and have a resistance not exceeding 6 megohms, when measured with a direct current potential of 500 volts or more.
- (f) The engine crankcase breather shall not be connected to the air intake system of the engine. The discharge from the breather shall be directed away from hot surfaces of the engine and exhaust system.
- (g) Electrical components on diesel power packages shall be certified or approved by MSHA under parts 7, 18, 20, and 27 of this chapter.
- (h) Electrical systems on diesel power packages consisting of electrical components, interconnecting wiring, and mechanical and electrical protection shall meet the requirements of parts 7, 18, and 27 of this chapter, as applicable.
- (i) The diesel power package shall be equipped with a safety shutdown system which will automatically shut off the fuel supply and stop the engine in response to signals from sensors indicating:
 - (1) The coolant temperature limit specified in paragraph (b) of this section;
 - (2) The exhaust gas temperature limit specified in paragraph (s)(4) of this section;
 - (3) The minimum allowable low water level, for a wet exhaust conditioner, as established by tests in [Sec. 7.100](#). Restarting of the engine shall be prevented until the water level in the wet exhaust conditioner has been replenished above the minimum allowable low water level; and
 - (4) The presence of other safety hazards such as high methane concentration, actuation of the fire suppression system, etc., if such sensors are included in the safety shutdown system.
- (j) The safety shutdown system shall have the following features:
 - (1) A means to automatically disable the starting circuit and prevent engagement of the starting mechanism while the engine is running, or a starting mechanism constructed of nonsparking materials.
 - (2) If the design of the safety shutdown system requires that the lack of engine oil pressure must be overridden to start the engine, the override shall not be capable of overriding any of the safety shutdown sensors specified in paragraph (i) of this section.
- (k) The diesel power package shall be explosion-proof as determined by the tests set out in [Sec. 7.100](#).
- (l) Engine joints that directly or indirectly connect the combustion chamber to the surrounding atmosphere shall be explosion-proof in accordance with paragraphs (m) through (q) of this section and [Sec. 7.100](#). This paragraph does not apply to the following:
 - (1) Pistons to piston rings;

- (2) Pistons to cylinder walls;
 - (3) Piston rings to cylinder walls;
 - (4) Cylinder head to cylinder block;
 - (5) Valve stem to valve guide; or
 - (6) Injector body to cylinder head.
- (m) Each segment of the intake system and exhaust system required to provide explosion-proof features shall be constructed of metal and designed to withstand a minimum internal pressure equal to four times the maximum pressure observed in that segment in tests under [Sec. 7.100](#) or a pressure of 150 psig, whichever is less. Castings shall be free from blowholes.
- (n) Welded joints forming the explosion-proof intake and exhaust systems shall be continuous and gas-tight. At a minimum, they shall be made in accordance with American Welding Society Standard D14.4-77 or meet the test requirements of [Sec. 7.104](#) with the internal pressure equal to four times the maximum pressure observed in tests under [Sec. 7.100](#) or a pressure of 150 psig, whichever is less.
- (o) Flexible connections shall be permitted in segments of the intake and exhaust systems required to provide explosion-proof features, provided that failure of the connection activates the safety shutdown system before the explosion-proof characteristics are lost.
- (p) Flame-arresting paths in the intake and exhaust systems shall be formed either by:
- (1) Flanged metal to metal joints meeting the requirements of paragraph (q) of this section; or
 - (2) Metal flanges fitted with metal gaskets and meeting the following requirements:
 - (i) Flat surfaces between bolt holes that form any part of a flame-arresting path shall be planed to within a maximum deviation of one-half the maximum clearance specified in paragraph (q)(7) of this section. All metal surfaces forming a flame-arresting path shall be finished during the manufacturing process to not more than 250 microinches.
 - (ii) A means shall be provided to ensure that fastenings maintain the tightness of joints. The means provided shall not lose its effectiveness through repeated assembly and disassembly.
 - (iii) Fastenings shall be as uniform in size as practicable to preclude improper assembly.
 - (iv) Holes for fastenings shall not penetrate to the interior of an intake or exhaust system and shall be threaded to ensure that all specified bolts or screws will not bottom even if the washers are omitted.
 - (v) Fastenings used for joints of flame-arresting paths on intake or exhaust systems shall be used only for attaching parts that are essential in maintaining the explosion-proof integrity. They shall not be used for attaching brackets or other parts.
 - (vi) The minimum thickness of material for flanges shall be 1/2- inch, except that a final thickness of 7/16-inch is allowed after machining rolled plate.
 - (vii) The maximum fastening spacing shall be 6 inches.

- (viii) The minimum diameter of fastenings shall be 3/8-inch, except smaller diameter fastenings may be used if the joint first meets the requirements of the static pressure test in Sec. 7.104, and the explosion test in [Sec. 7.100](#).
- (ix) The minimum thread engagement of fastenings shall be equal to or greater than the nominal diameter of the fastenings specified, or the intake or exhaust system must meet the test requirements of the explosion tests in [Sec. 7.100](#) and the static pressure test in [Sec. 7.104](#).
- (x) The minimum contact surface of gaskets forming flame-arresting paths shall be 3/8-inch, and the thickness of the gaskets shall be no greater than 1/16-inch. The minimum distance from the interior edge of a gasket to the edge of a fastening hole shall be 3/8-inch. The gaskets shall be positively positioned and a means shall be provided to preclude improper installation. When the joint is completely assembled, it shall be impossible to insert a 0.0015-inch thickness gauge to a depth exceeding 1/8-inch between the gasket and mating flanges. Other gasket designs shall be evaluated in accordance with [Sec. 7.107](#).
- (q) The following construction requirements shall apply to flame-arresting paths formed without gaskets:
 - (1) Flat surfaces between fastening holes that form any part of a flame-arresting path shall be planed to within a maximum deviation of one-half the maximum clearance specified in paragraph (q)(7) of this section. All metal surfaces forming a flame-arresting path shall be finished during the manufacturing process to not more than 250 microinches. A thin film of nonhardening preparation to inhibit rusting may be applied to these finished metal surfaces, as long as the final surface can be readily wiped free of any foreign materials.
 - (2) A means shall be provided to ensure that fastenings maintain the tightness of joints. The means provided shall not lose its effectiveness through repeated assembly and disassembly.
 - (3) Fastenings shall be as uniform in size as practicable to preclude improper assembly.
 - (4) Holes for fastenings shall not penetrate to the interior of an intake or exhaust system and shall be threaded to ensure that all specified bolts or screws will not bottom even if the washers are omitted.
 - (5) Fastenings used for joints of flame-arresting paths on intake or exhaust systems shall be used only for attaching parts that are essential in maintaining the explosion-proof integrity. They shall not be used for attaching brackets or other parts.
 - (6) The flame-arresting path of threaded joints shall conform to the requirements of paragraph (q)(7) of this section.
 - (7) Intake and exhaust systems' joints shall meet the specifications set out in Table F-1.

Table F-1.--Dimensional Requirements for Explosion-Proof Intake and Exhaust System Joints

Minimum thickness of material for flanges.....	1/2" ¹
Minimum width of joint; all in one plane.....	1"
Maximum clearance; joint all in one plane.....	0.004"
Minimum width of joint, portions of which are different planes; cylinders or equivalent.	3/4" ²

Maximum clearances; joint in two or more planes,
 cylinders or equivalent:
 Portion perpendicular to plane..... 0.008" ³
 Plane portion..... 0.006"
 Maximum fastening ⁴ spacing; joints all in one 6"
 plane ⁵.
 Maximum fastening spacing; joints, portions of 8"
 which are in different planes.
 Minimum diameter of fastening (without regard to 3/8"
 type of joint) ⁶.
 Minimum thread engagement of fastening ⁷ " "
 Maximum diametrical clearance between fastening
 body and unthreaded holes through which it
 passes ^{8 9 10} 7/16"
 Minimum distance from interior of the intake or
 exhaust system to the edge of a fastening hole:¹¹
 Joint-minimum width 1" 7/16 " ^{8 12}.
 Shafts centered by ball or roller bearings:
 Minimum length of flame-arresting path..... 1"
 Maximum diametrical clearance..... 0.030"
 Other cylindrical joints:
 Minimum length of flame-arresting path..... 1"
 Maximum diametrical clearance..... 0.010"

¹ 1/16-inch less is allowable for machining rolled plate.

² If only two planes are involved, neither portion of a joint shall be less than 1/8-inch wide, unless the wider portion conforms to the same requirements as those for a joint that is all in one plane. If more than two planes are involved (as in labyrinths or tongue-in-groove joints), the combined lengths of those portions having prescribed clearances are considered.

³ The allowable diametrical clearance is 0.008-inch when the portion perpendicular to the plane portion is 1/4-inch or greater in length.
 If the perpendicular portion is more than 1/8-inch but less than 1/4-inch wide, the diametrical clearance shall not exceed 0.006-inch.

⁴ Studs, when provided, shall bottom in blind holes, be completely welded in place, or have the bottom of the hole closed with a plug secured by weld or braze. Fastenings shall be provided at all corners.

⁵ The requirements as to diametrical clearance around the fastening and minimum distance from the fastening hole to the inside of the intake or exhaust system apply to steel dowel pins. In addition, when such pins are used, the spacing between centers of the fastenings on either side of the pin shall not exceed 5 inches.

⁶ Fastening diameters smaller than specified may be used if the joint or assembly meets the test requirements of [Sec. 7.104](#).

⁷ Minimum thread engagement shall be equal to or greater than the nominal diameter of the fastening specified, or the intake or exhaust system must meet the test requirements of [Sec. 7.104](#).

⁸ The requirements as to diametrical clearance around the fastening and minimum distance from the fastening hole to the inside of the intake or exhaust system apply to steel dowel pins. In addition, when such pins are used, the spacing between centers of the fastenings on either side of the pin shall not exceed 5 inches.

⁹ This maximum clearance only applies when the fastening is located within the flame-arresting path.

¹⁰ Threaded holes for fastenings shall be machined to remove burrs or projections that affect planarity of a surface forming a flame-arresting path.

¹¹ Edge of the fastening hole shall include any edge of any machining done to the fastening hole, such as chamfering.

¹² If the diametrical clearance for fastenings does not exceed 1/32-inch, then the minimum distance shall be 1/4-inch.

(r) Intake system.

(1) The intake system shall include a device between the air cleaner and intake flame arrester, operable from the equipment operator's compartment, to shut off the air supply to the engine for emergency purposes. Upon activation, the device must operate immediately and the engine shall stop within 15 seconds.

(2) The intake system shall include a flame arrester that will prevent an explosion within the system from propagating to a surrounding flammable mixture when tested in accordance with the explosion tests in [Sec. 7.100](#). The flame arrester shall be located between the air cleaner and the intake manifold and shall be attached so that it can be removed for inspection or cleaning. The flame arrester shall be constructed of corrosion-resistant metal and meet the following requirements:

(i) Two intake flame arrester designs, the spaced-plate type and the crimped ribbon type, will be tested in accordance with the requirements of [Sec. 7.100](#). Variations to these designs or other intake flame arrester designs will be evaluated under the provisions of [Sec. 7.107](#).

(ii) In flame arresters of the spaced-plate type, the thickness of the plates shall be at least 0.125-inch; spacing between the plates shall not exceed 0.018-inch; and the flame-arresting path formed by the plates shall be at least 1-inch wide. The unsupported length of the plates shall be short enough that permanent deformation resulting from explosion tests shall not exceed 0.002-inch. The plates and flame arrester housing shall be an integral unit which cannot be disassembled.

(iii) In flame arresters of the crimped ribbon type, the dimensions of the core openings shall be such that a plug gauge 0.018-inch in diameter shall not pass through, and the flame-arresting path core thickness shall be at least 1 inch. The core and flame arrester housing shall be an integral unit which cannot be disassembled.

(3) The intake system shall be designed so that improper installation of the flame arrester is impossible.

(4) The intake system shall include an air cleaner service indicator. The air cleaner shall be installed so that only filtered air will enter the flame arrester. The air cleaner shall be sized and the service indicator set in accordance with the engine manufacturer's recommendations. Unless the service indicator is explosion-proof, it shall be located between the air cleaner and flame arrester, and the service indicator setting shall be reduced to account for the additional restriction imposed by the flame arrester.

(5) The intake system shall include a connection between the intake flame arrester and the engine head for temporary attachment of a device to indicate the total vacuum in the system.

This opening shall be closed by a plug or other suitable device that is sealed or locked in place except when in use.

(s) Exhaust system.

- (1) The exhaust system shall include a flame arrester that will prevent propagation of flame or discharge of glowing particles to a surrounding flammable mixture. The flame arrester shall be constructed of corrosion-resistant metal.
 - (i) If a mechanical flame arrester is used, it shall be positioned so that only cooled exhaust gas at a maximum temperature of 302°F (150°C) will be discharged through it.
 - (ii) If a mechanical flame arrester of the spaced-plate type is used, it must meet the requirements of paragraph (r)(2)(ii) of this section and the test requirements of [Sec. 7.100](#). Variations to the spaced-plate flame arrester design and other mechanical flame arrester designs shall be evaluated under the provisions of [Sec. 7.107](#). The flame arrester shall be designed and attached so that it can be removed for inspection and cleaning.
- (2) The exhaust system shall allow a wet exhaust conditioner to be used as the exhaust flame arrester provided that the explosion tests of [Sec. 7.100](#) demonstrate that the wet exhaust conditioner will arrest flame. When used as a flame arrester, the wet exhaust conditioner shall be equipped with a sensor to automatically activate the safety shutdown system at or above the minimum allowable low water level established by [Sec. 7.100](#). Restarting of the engine shall be prevented until the water supply in the wet exhaust conditioner has been replenished above the minimum allowable low water level. All parts of the wet exhaust conditioner and associated components that come in contact with contaminated exhaust conditioner water shall be constructed of corrosion-resistant material. The wet exhaust conditioner shall include a means for verifying that the safety shutdown system operates at the proper water level. A means shall be provided for draining and cleaning the wet exhaust conditioner. The final exhaust gas temperature at discharge from the wet exhaust conditioner shall not exceed 170°F (76°C) under test conditions specified in [Sec. 7.102](#). A sensor shall be provided that activates the safety shutdown system before the exhaust gas temperature at discharge from the wet exhaust conditioner exceeds 185°F (85°C) under test conditions specified in [Sec. 7.103\(a\)\(4\)](#).
- (3) The exhaust system shall be designed so that improper installation of the flame arrester is impossible.
- (4) The exhaust system shall provide a means to cool the exhaust gas and prevent discharge of glowing particles.
 - (i) When a wet exhaust conditioner is used to cool the exhaust gas and prevent the discharge of glowing particles, the temperature of the exhaust gas at the discharge from the exhaust conditioner shall not exceed 170°F (76°C) when tested in accordance with the exhaust gas cooling efficiency test in [Sec. 7.102](#). A sensor shall be provided that activates the safety shutdown system before the exhaust gas temperature at discharge from the wet exhaust conditioner exceeds 185°F (85°C) when tested in accordance with the safety system controls test in [Sec. 7.103](#). All parts of the wet exhaust conditioner and associated components that come in contact with contaminated exhaust conditioner water shall be constructed of corrosion-resistant material.

- (ii) When a dry exhaust conditioner is used to cool the exhaust gas, the temperature of the exhaust gas at discharge from the diesel power package shall not exceed 302°F (150°C) when tested in accordance with the exhaust gas cooling efficiency test of [Sec. 7.102](#). A sensor shall be provided that activates the safety shutdown system before the exhaust gas exceeds 302°F (150°C) when tested in accordance with the safety system control test in [Sec. 7.103](#). A means shall be provided to prevent the discharge of glowing particles, and it shall be evaluated under the provisions of [Sec. 7.107](#).
- (5) Other means for cooling the exhaust gas and preventing the propagation of flame or discharge of glowing particles shall be evaluated under the provisions of [Sec. 7.107](#).
- (6) There shall be a connection in the exhaust system for temporary attachment of a device to indicate the total backpressure in the system and collection of exhaust gas samples. This opening shall be closed by a plug or other suitable device that is sealed or locked in place except when in use.

PART 36--APPROVAL REQUIREMENTS FOR PERMISSIBLE MOBILE DIESEL-POWERED TRANSPORTATION EQUIPMENT.

Subpart A--General Provisions

30 CFR § 36.2

Definitions.

The following definitions apply in this part.

Applicant. An individual, partnership, company, corporation, association, or other organization that designs, manufactures, assembles, or controls the assembly and that seeks a certificate of approval or preliminary testing of mobile diesel-powered transportation equipment as permissible.

Certificate of approval. A formal document issued by MSHA stating that the complete assembly has met the requirements of this part for mobile diesel-powered transportation equipment and authorizing the use and attachment of an official approval plate so indicating.

Component. A piece, part, or fixture of mobile diesel-powered transportation equipment that is essential to its operation as a permissible assembly.

Diesel engine. A compression-ignition, internal-combustion engine that utilizes diesel fuel.

Explosion proof. A component or subassembly that is so constructed and protected by an enclosure and/or flame arrester(s) that if a flammable mixture of gas is ignited within the enclosure it will withstand the resultant pressure without damage to the enclosure and/or flame arrester(s). Also the enclosure and/or flame arrester(s) shall prevent the discharge of flame or ignition of any flammable mixture that surrounds the enclosure.

Flame arrester. A device so constructed that flame or sparks from the diesel engine cannot propagate an explosion of a flammable mixture through it.

Flammable mixture. A mixture of gas, such as methane, natural gas, or similar hydrocarbon gas with normal air, that will propagate flame or explode violently when initiated by an incendive source.

Fuel-air ratio. The composition of the mixture of fuel and air in the combustion chamber of the diesel engine expressed as weight-pound of fuel per pound of air.

MSHA. The United States Department of Labor, Mine Safety and Health Administration.

Mobile diesel-powered transportation equipment. Equipment that is:

- (1) Used for transporting the product being mined or excavated, or for transporting materials and supplies used in mining or excavating operations;
- (2) Mounted on wheels or crawler treads (tracks); and
- (3) Powered by a diesel engine as the prime mover.

Normal operation. When each component and the entire assembly of the mobile diesel-powered transportation equipment performs the functions for which they were designed.

Permissible. As applied to mobile diesel-powered transportation equipment, this means that the complete assembly conforms to the requirements of this part and that a certificate of approval to that effect has been issued.

Subassembly. A group or combination of components.

[61 FR 55525, Oct. 25, 1996]

Subpart T -- Diesel Exhaust Gas Monitoring

30 CFR § 70.1900

Exhaust Gas Monitoring.

- (a) During on-shift examinations required by [Sec. 75.362](#), a certified person as defined by [Sec. 75.100](#) of this chapter and designated by the operator as trained or experienced in the appropriate sampling procedures, shall determine the concentration of carbon monoxide (CO) and nitrogen dioxide (NO²):
 - (1) In the return of each working section where diesel equipment is used, at a location which represents the contribution of all diesel equipment on such section;
 - (2) In the area of the section loading point if diesel haulage equipment is operated on the working section;
 - (3) At a point inby the last piece of diesel equipment on the longwall or shortwall face when mining equipment is being installed or removed; and
 - (4) In any other area designated by the district manager as specified in the mine operator's approved ventilation plan where diesel equipment is operated in a manner which can result in significant concentrations of diesel exhaust.
- (b) Samples of CO and NO² shall be--

- (1) Collected in a manner that makes the results available immediately to the person collecting the samples;
 - (2) Collected and analyzed by appropriate instrumentation which has been maintained and calibrated in accordance with the manufacturer's recommendations; and
 - (3) Collected during periods that are representative of conditions during normal operations.
- (c) Except as provided in [Sec. 75.325\(j\)](#) of this chapter, when sampling results indicate a concentration of CO and/or NO² exceeding an action level of 50 percent of the threshold limit values (TLV[®]) adopted by the American Conference of Governmental Industrial Hygienists, the mine operator shall immediately take appropriate corrective action to reduce the concentrations of CO and/or NO² to below the applicable action level. The publication, "Threshold Limit Values for Substance in Workroom Air" (1972), is incorporated by reference and may be inspected at MSHA's Office of Standards, Regulations, and Variances, 1100 Wilson Boulevard Room 2352, Arlington, Virginia 22209-3939; at any Coal Mine Health and Safety District and Subdistrict Office; and at the Office of the Federal Register, 800 North Capitol Street, NW Suite 700, Washington, DC. This incorporation by reference was approved by the director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. In addition, copies of the document may be purchased from the Secretary-Treasurer, American Conference of Governmental Industrial Hygienists, Post Office Box 1937, Cincinnati, OH 45202.
- (d) A record shall be made when sampling results exceed the action level for the applicable TLV[®] for CO and/or NO₂. The record shall be made as part of and in the same manner as the records for hazards required by [Sec. 75.363](#) of this chapter and include the following:
- (1) Location where each sample was collected;
 - (2) Substance sampled and the measured concentration; and
 - (3) Corrective action taken to reduce the concentration of CO and/ or NO² to or below the applicable action level.
- (e) As of November 25, 1997, exhaust gas monitoring shall be conducted in accordance with the requirements of this section.

PART 75--MANDATORY SAFETY STANDARDS UNDERGROUND COAL MINES

Subpart T --Diesel-Powered Equipment

30 CFR § 75.1900

Definitions.

The following definitions apply in this subpart.

Diesel fuel tank. A closed metal vessel specifically designed for the storage or transport of diesel fuel.

Diesel fuel transportation unit. A self-propelled or portable wheeled vehicle used to transport a diesel fuel tank.

Noncombustible material. A material that will continue to serve its intended function for 1 hour when subjected to a fire test incorporating an ASTM E119-88 time/temperature heat input, or equivalent. The publication ASTM E119-88 "Standard Test Methods for Fire Tests of Building Construction and Materials" is incorporated by reference and may be inspected at any Coal Mine Health and Safety District and Subdistrict Office; at MSHA's Office of Standards, Regulations, and Variances, 1100 Wilson Boulevard Room 2352, Arlington, Virginia 22209-3939; or at the Office of the Federal Register, 800 North Capitol Street, NW, Washington, DC. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. In addition, copies of the document may be purchased from the American Society for Testing Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103.

Permanent underground diesel fuel storage facility. A facility designed and constructed to remain at one location for the storage or dispensing of diesel fuel, which does not move as mining progresses.

Safety can. A metal container intended for storage, transport or dispensing of diesel fuel, with a nominal capacity of 5 gallons, listed or approved by a nationally recognized independent testing laboratory.

Temporary underground diesel fuel storage area. An area of the mine provided for the short-term storage of diesel fuel in a fuel transportation unit, which moves as mining progresses.

30 CFR § 75.1901

Diesel fuel requirements.

- (a) Diesel-powered equipment shall be used underground only with a diesel fuel having a sulfur content no greater than 0.05 percent and a flash point of 100°F (38°C) or greater. Upon request, the mine operator shall provide to an authorized representative of the Secretary evidence that the diesel fuel purchased for use in diesel-powered equipment underground meets these requirements.
- (b) Flammable liquids shall not be added to diesel fuel used in diesel-powered equipment underground.
- (c) Only [diesel fuel additives](#) that have been registered by the Environmental Protection Agency may be used in diesel-powered equipment underground.

30 CFR § 75.1902

Underground diesel fuel storage--general requirements.

- (a) All diesel fuel must be stored in:
 - (1) Diesel fuel tanks in permanent underground diesel fuel storage facilities;
 - (2) Diesel fuel tanks on diesel fuel transportation units in permanent underground diesel fuel storage facilities or in temporary underground fuel storage areas; or
 - (3) Safety cans.
- (b) The total capacity of stationary diesel fuel tanks in permanent underground diesel fuel storage facilities must not exceed 1000 gallons.

- (c)(1) Only one temporary underground diesel fuel storage area is permitted for each working section or in each area of the mine where equipment is being installed or removed.
- (2) The temporary underground diesel fuel storage area must be located:
 - (i) Within 500 feet of the loading point;
 - (ii) Within 500 feet of the projected loading point where equipment is being installed; or
 - (iii) Within 500 feet of the last loading point where equipment is being removed.
- (3) No more than one diesel fuel transportation unit at a time shall be parked in the temporary underground diesel fuel storage area.
- (d) Permanent underground diesel fuel storage facilities and temporary underground diesel fuel storage areas must be:
 - (1) At least 100 feet from shafts, slopes, shops, or explosives magazines;
 - (2) At least 25 feet from trolley wires or power cables, or electric equipment not necessary for the operation of the storage facilities or areas; and
 - (3) In a location that is protected from damage by other mobile equipment.
- (e) Permanent underground diesel fuel storage facilities must not be located within the primary escapeway.

30 CFR § 75.1903

Underground diesel fuel storage facilities and areas; construction and safety precautions.

- (a) Permanent underground diesel fuel storage facilities must be:
 - (1) Constructed of noncombustible materials, including floors, roofs, roof supports, doors, and door frames. Exposed coal within fuel storage areas must be covered with noncombustible materials. If bulkheads are used they must be tightly sealed and must be built of or covered with noncombustible materials;
 - (2) Provided with either self-closing doors or a means for automatic enclosure;
 - (3) Provided with a means for personnel to enter and exit the facility after closure;
 - (4) Ventilated with intake air that is coursed into a return air course or to the surface and that is not used to ventilate working places, using ventilation controls meeting the requirements of [Sec. 75.333\(e\)](#);
 - (5) Equipped with an automatic fire suppression system that meets the requirements of [Sec. 75.1912](#). Actuation of the automatic fire suppression system shall initiate the means for automatic enclosure;
 - (6) Provided with a means of containment capable of holding 150 percent of the maximum capacity of the fuel storage system; and
 - (7) Provided with a competent concrete floor or equivalent to prevent fuel spills from saturating the mine floor.

- (b) Permanent underground diesel fuel storage facilities and temporary underground diesel fuel storage areas must be:
 - (1) Equipped with at least 240 pounds of rock dust and provided with two portable multipurpose dry chemical type (ABC) fire extinguishers that are listed or approved by a nationally recognized independent testing laboratory and have a 10A:60B:C or higher rating. Both fire extinguishers must be easily accessible to personnel, and at least one fire extinguisher must be located outside of the storage facility or area upwind of the facility, in intake air; or
 - (2) Provided with three portable multipurpose dry chemical type (ABC) fire extinguishers that are listed or approved by a nationally recognized independent testing laboratory and have a 10A:60B:C or higher rating. All fire extinguishers must be easily accessible to personnel, and at least one fire extinguisher must be located outside of the storage facility or area upwind of the facility, in intake air.
 - (3) Identified with conspicuous markings designating diesel fuel storage; and
 - (4) Maintained to prevent the accumulation of water.
- (c) Welding or cutting other than that performed in accordance with paragraph (d) of this section shall not be performed within 50 feet of a permanent underground diesel fuel storage facility or a temporary underground diesel fuel storage area.
- (d) When it is necessary to weld, cut, or solder pipelines, tanks, or other containers that may have contained diesel fuel, these practices shall be followed:
 - (1) Cutting or welding shall not be performed on or within pipelines, tanks, or other containers that have contained diesel fuel until they have been thoroughly purged and cleaned or inerted and a vent or opening is provided to allow for sufficient release of any buildup pressure before heat is applied.
 - (2) Diesel fuel shall not be allowed to enter pipelines, tanks, or containers that have been welded, soldered, brazed, or cut until the metal has cooled to ambient temperature.

30 CFR § 75.1904

Underground diesel fuel tanks and safety cans.

- (a) Diesel fuel tanks used underground shall:
 - (1) Have steel walls of a minimum 3/16-inch thickness, or walls made of other metal of a thickness that provides equivalent strength;
 - (2) Be protected from corrosion;
 - (3) Be of seamless construction or have liquid tight welded seams;
 - (4) Not leak; and
 - (5) For stationary tanks in permanent underground diesel fuel storage facilities, be placed on supports constructed of noncombustible material so that the tanks are at least 12 inches above the floor.
- (b) Underground diesel fuel tanks must be provided with:

- (1) Devices for emergency venting designed to open at a pressure not to exceed 2.5 psi according to the following:
 - (i) Tanks with a capacity greater than 500 gallons must have an emergency venting device whose area is equivalent to a pipe with a nominal inside diameter of 5 inches or greater; and
 - (ii) Tanks with a capacity of 500 gallons or less must have an emergency venting device whose area is equivalent to a pipe with a nominal inside diameter of 4 inches or greater.
 - (2) Tethered or self-closing caps for stationary tanks in permanent underground diesel fuel storage facilities and self-closing caps for diesel fuel tanks on diesel fuel transportation units;
 - (3) Vents to permit the free discharge of liquid, at least as large as the fill or withdrawal connection, whichever is larger, but not less than 1^{1/4} inch nominal inside diameter;
 - (4) Liquid tight connections for all tank openings that are:
 - (i) Identified by conspicuous markings that specify the function; and
 - (ii) Closed when not in use.
 - (5) Vent pipes that drain toward the tank without sagging and are higher than the fill pipe opening;
 - (6) Shutoff valves located as close as practicable to the tank shell on each connection through which liquid can normally flow; and
 - (7) An automatic closing, heat-actuated valve on each withdrawal connection below the liquid level.
- (c) When tanks are provided with openings for manual gauging, liquid tight, tethered or self-closing caps or covers must be provided and must be kept closed when not open for gauging.
 - (d) Surfaces of the tank and its associated components must be protected against damage by collision.
 - (e) Before being placed in service, tanks and their associated components must be tested for leakage at a pressure equal to the working pressure, except tanks and components connected directly to piping systems, which must be properly designed for the application.
 - (f) Safety cans must be:
 - (1) Limited to a nominal capacity of 5 gallons or less;
 - (2) Equipped with a flexible or rigid tubular nozzle attached to a valved spout;
 - (3) Provided with a vent valve designed to open and close simultaneously and automatically with the opening and closing of the pouring valve; and
 - (4) Designed so that they will safely relieve internal pressure when exposed to fire.

30 CFR § 75.1905

Dispensing of diesel fuel.

- (a) Diesel-powered equipment in underground coal mines may be refueled only from safety cans, from tanks on diesel fuel transportation units, or from stationary tanks.
- (b) Fuel that is dispensed from other than safety cans must be dispensed by means of:
 - (1) Gravity feed with a hose equipped with a nozzle with a self-closing valve and no latch-open device;
 - (2) A manual pump with a hose equipped with a nozzle containing a self-closing valve; or
 - (3) A powered pump with:
 - (i) An accessible emergency shutoff switch for each nozzle;
 - (ii) A hose equipped with a self-closing valve and no latch-open device; and
 - (iii) An anti-siphoning device.
- (c) Diesel fuel must not be dispensed using compressed gas.
- (d) Diesel fuel must not be dispensed to the fuel tank of diesel-powered equipment while the equipment engine is running.
- (e) Powered pumps shall be shut off when fuel is not being dispensed.

30 CFR § 75.1905-1

Diesel fuel piping systems.

- (a) Diesel fuel piping systems from the surface must be designed and operated as dry systems, unless an automatic shutdown is incorporated that prevents accidental loss or spillage of fuel and that activates an alarm system.
- (b) All piping, valves, and fittings must be:
 - (1) Capable of withstanding working pressures, and stresses;
 - (2) Capable of withstanding four times the static pressures;
 - (3) Compatible with diesel fuel; and
 - (4) Maintained in a manner that prevents leakage.
- (c) Pipelines must have manual shutoff valves installed at the surface filling point and at the underground discharge point.
- (d) If diesel fuel lines are not buried in the ground sufficiently to protect them from damage, shutoff valves must be located every 300 feet.
- (e) Shutoff valves must be installed at each branch line where the branch line joins the main line.
- (f) An automatic means must be provided to prevent unintentional transfer of diesel fuel from the surface into the permanent underground diesel fuel storage facility.

- (g) Diesel fuel piping systems from the surface shall only be used to transport diesel fuel directly to stationary tanks or diesel fuel transportation units in a permanent underground diesel fuel storage facility.
- (h) The diesel fuel piping system must not be located in a borehole with electric power cables.
- (i) Diesel fuel piping systems located in entries must not be located on the same side of the entry as electric cables or power lines. Where it is necessary for piping systems to cross electric cables or power lines, guarding must be provided to prevent severed electrical cables or power lines near broken fuel lines.
- (j) Diesel fuel piping systems must be protected and located to prevent physical damage.

30 CFR § 75.1906

Transport of diesel fuel.

- (a) Diesel fuel shall be transported only by diesel fuel transportation units or in safety cans.
- (b) No more than one safety can shall be transported on a vehicle at any time. The can must be protected from damage during transport. All other safety cans must be stored in permanent underground diesel fuel storage facilities.
- (c) Safety cans that leak must be promptly removed from the mine.
- (d) Diesel fuel transportation unit tanks and safety cans must be conspicuously marked as containing diesel fuel.
- (e) Diesel fuel transportation units must transport no more than 500 gallons of diesel fuel at a time.
- (f) Tanks on diesel fuel transportation units must be permanently fixed to the unit and have a total capacity of no greater than 500 gallons of diesel fuel.
- (g) Non-self-propelled diesel fuel transportation units with electrical components for dispensing fuel that are connected to a source of electrical power must be protected by a fire suppression device that meets the requirements of Secs. 75.1107-3 through 75.1107-6, and Secs. 75.1107-8 through 75.1107-16.
- (h) Diesel fuel transportation units and vehicles transporting safety cans containing diesel fuel must have at least two multipurpose, dry chemical type (ABC) fire extinguishers, listed or approved by a nationally recognized independent testing laboratory and having a 10A:60B:C or higher rating, with one fire extinguisher provided on each side of the vehicle.
- (i) Diesel fuel transportation units shall be parked only in permanent underground diesel fuel storage facilities or temporary underground diesel fuel storage areas when not in use.
- (j) When the distance between a diesel fuel transportation unit and an energized trolley wire at any location is less than 12 inches, the requirements of Sec. 75.1003-2 must be followed.
- (k) Diesel fuel shall not be transported on or with mantrips or on conveyor belts.
- (l) Diesel fuel shall be stored and handled in accordance with the requirements of Secs. 75.1902 through 75.1906 of this part as of November 25, 1997.

[61 FR 55527, Oct. 25, 1996, as amended at 63 FR 12647, Mar. 16, 1998]

30 CFR § 75.1907

Diesel-powered equipment intended for use in underground coal mines.

- (a) As of November 25, 1996, all diesel-powered equipment used where permissible electrical equipment is required must be approved under part 36 of this chapter.
- (b) Diesel-powered equipment approved under part 36 of this chapter must be provided with additional safety features in accordance with the following time schedule:
 - (1) As of April 25, 1997, the equipment must have a safety component system that limits surface temperatures to those specified in subpart F of part 7 of this title;
 - (2) As of November 25, 1999, the equipment must have an automatic or manual fire suppression system that meets the requirements of [Sec. 75.1911](#) of this part, and at least one portable multipurpose dry chemical type (ABC) fire extinguisher, listed or approved by a nationally recognized independent testing laboratory and having a 10A:60B:C or higher rating. The fire extinguisher must be located within easy reach of the equipment operator and be protected from damage by collision.
 - (3) As of November 25, 1999, the equipment must have a brake system that meets the requirements of [Sec. 75.1909](#) (b)(6), (b)(7), (b)(8), (c), (d), and (e);
 - (4) As of November 25, 1997, a particulate index and dilution air quantity shall be determined for the equipment in accordance with subpart E of part 7 of this chapter; and
 - (5) Permissible diesel-powered equipment manufactured on or after November 25, 1999, and that is used in an underground coal mine shall incorporate a power package approved in accordance with part 7, subpart F of this chapter.
- (c) As of November 25, 1999, nonpermissible diesel-powered equipment, except the special category of equipment under [Sec. 75.1908](#)(d), shall meet the requirements of [Secs. 75.1909](#) and [75.1910](#) of this part.

30 CFR § 75.1908

Nonpermissible diesel-powered equipment--categories.

- (a) Heavy-duty diesel-powered equipment includes:
 - (1) Equipment that cuts or moves rock or coal;
 - (2) Equipment that performs drilling or bolting functions;
 - (3) Equipment that moves longwall components;
 - (4) Self-propelled diesel fuel transportation units and self-propelled lube units; or
 - (5) Machines used to transport portable diesel fuel transportation units or portable lube units.
- (b) Light-duty diesel-powered equipment is any diesel-powered equipment that does not meet the criteria of paragraph (a).
- (c) For the purposes of this subpart, the following equipment is considered attended:
 - (1) Any machine or device operated by a miner; or

(2) Any machine or device that is mounted in the direct line of sight of a job site located within 500 feet of such machine or device, which job site is occupied by a miner.

(d) Diesel-powered ambulances and fire fighting equipment are a special category of equipment that may be used underground only in accordance with the mine fire fighting and evacuation plan under [Sec. 75.1101-23](#).

30 CFR § 75.1909

Nonpermissible diesel-powered equipment; design and performance requirements.

(a) Nonpermissible diesel-powered equipment, except for the special category of equipment under [Sec. 75.1908\(d\)](#), must be equipped with the following features:

- (1) An engine approved under subpart E of part 7 of this title equipped with an air filter sized in accordance with the engine manufacturer's recommendations, and an air filter service indicator set in accordance with the engine manufacturer's recommendations;
- (2) At least one portable multipurpose dry chemical type (ABC) fire extinguisher listed or approved by a nationally recognized independent testing laboratory with a 10A:60B:C or higher rating. The fire extinguisher must be located within easy reach of the equipment operator and protected from damage;
- (3) A fuel system specifically designed for diesel fuel meeting the following requirements:
 - (i) A fuel tank and fuel lines that do not leak;
 - (ii) A fuel tank that is substantially constructed and protected against damage by collision;
 - (iii) A vent opening that maintains atmospheric pressure in the fuel tank, and that is designed to prevent fuel from splashing out of the vent opening;
 - (iv) A self-closing filler cap on the fuel tank;
 - (v) The fuel tank, filler, and vent must be located so that leaks or spillage during refueling will not contact hot surfaces;
 - (vi) Fuel line piping must be either steel-wire reinforced; synthetic elastomer-covered hose suitable for use with diesel fuel that has been tested and has been determined to be fire-resistant by the manufacturer; or metal;
 - (vii) Fuel line piping must be clamped;
 - (viii) Primary fuel lines must be located so that fuel line leaks do not contact hot surfaces;
 - (ix) The fuel lines must be separated from electrical wiring and protected from damage in ordinary use;
 - (x) A manual shutoff valve must be installed in the fuel system as close as practicable to the tank; and
 - (xi) A water separator and fuel filter(s) must be provided.
- (4) A sensor to monitor the temperature and provide a visual warning of an overheated cylinder head on air-cooled engines;

- (5) Guarding to protect fuel, hydraulic, and electric lines when such lines pass near rotating parts or in the event of shaft failure;
 - (6) Hydraulic tanks, fillers, vents, and lines located to prevent spillage or leaks from contacting hot surfaces;
 - (7) Reflectors or warning lights mounted on the equipment which can be readily seen in all directions;
 - (8) A means to direct exhaust gas away from the equipment operator, persons on board the machine, and combustible machine components;
 - (9) A means to prevent unintentional free and uncontrolled descent of personnel-elevating work platforms; and
 - (10) A means to prevent the spray from ruptured hydraulic or lubricating oil lines from being ignited by contact with engine exhaust system component surfaces.
- (b) Self-propelled nonpermissible diesel-powered equipment must have the following features in addition to those in paragraph (a):
- (1) A means to ensure that no stored hydraulic energy that will cause machine articulation is available after the engine is shut down;
 - (2) A neutral start feature which ensures that engine cranking torque will not be transmitted through the powertrain and cause machine movement on vehicles utilizing fluid power transmissions;
 - (3) For machines with steering wheels, brake pedals, and accelerator pedals, controls which are of automobile orientation;
 - (4) An audible warning device conveniently located near the equipment operator;
 - (5) Lights provided and maintained on both ends of the equipment. Equipment normally operated in both directions must be equipped with headlights for both directions;
 - (6) Service brakes that act on each wheel of the vehicle and that are designed such that failure of any single component, except the brake actuation pedal or other similar actuation device, must not result in a complete loss of service braking capability;
 - (7) Service brakes that safely bring the fully loaded vehicle to a complete stop on the maximum grade on which it is operated; and
 - (8) No device that traps a column of fluid to hold the brake in the applied position shall be installed in any brake system, unless the trapped column of fluid is released when the equipment operator is no longer in contact with the brake activation device.
- (c) Self-propelled nonpermissible heavy-duty diesel-powered equipment under [Sec. 75.1908\(a\)](#), except rail-mounted equipment, shall be provided with a supplemental braking system that:
- (1) Engages automatically within 5 seconds of the shutdown of the engine;
 - (2) Safely brings the equipment when fully loaded to a complete stop on the maximum grade on which it is operated;

- (3) Holds the equipment stationary, despite any contraction of brake parts, exhaustion of any nonmechanical source of energy, or leakage;
 - (4) Releases only by a manual control that does not operate any other equipment function;
 - (5) Has a means in the equipment operator's compartment to apply the brakes manually without shutting down the engine, and a means to release and re-engage the brakes without the engine operating; and
 - (6) Has a means to ensure that the supplemental braking system is released before the equipment can be trammed and is designed to ensure the brake is fully released at all times while the equipment is trammed.
- (d) Self-propelled nonpermissible light-duty diesel-powered equipment under [Sec. 75.1908\(b\)](#), except rail-mounted equipment, must be provided with a parking brake that holds the fully loaded equipment stationary on the maximum grade on which it is operated despite any contraction of the brake parts, exhaustion of any nonmechanical source of energy, or leakage.
 - (e) The supplemental and park brake systems required by paragraphs (c) and (d) must be applied when the equipment operator is not at the controls of the equipment, except during movement of disabled equipment.
 - (f) Self-propelled personnel-elevating work platforms must be provided with a means to ensure that the parking braking system is released before the equipment can be trammed and must be designed to ensure the brake is fully released at all times while the equipment is trammed.
 - (g) Any nonpermissible equipment that discharges its exhaust directly into a return air course must be provided with a power package approved under subpart F of part 7 of this title.
 - (h) Self-propelled nonpermissible heavy-duty diesel-powered equipment meeting the requirements of [Sec. 75.1908\(a\)](#) must be provided with an automatic fire suppression system meeting the requirements of [Sec. 75.1911](#).
 - (i) Self-propelled nonpermissible light-duty diesel-powered equipment meeting the requirements of [Sec. 75.1908\(b\)](#) must be provided with an automatic or manual fire suppression system meeting the requirements of [Sec. 75.1911](#).
 - (j) Nonpermissible equipment that is not self-propelled must have the following features in addition to those listed in paragraph (a):
 - (1) A means to prevent inadvertent movement of the equipment when parked;
 - (2) Safety chains or other suitable secondary connections on equipment that is being towed; and
 - (3) An automatic fire suppression system meeting the requirements of [Sec. 75.1911](#).

30 CFR § 75.1910

Nonpermissible diesel-powered equipment; electrical system design and performance requirements.

Electrical circuits and components associated with or connected to electrical systems on nonpermissible diesel-powered equipment utilizing storage batteries and integral charging systems,

except for the special category of equipment under [Sec. 75.1908\(d\)](#), must conform to the following requirements:

- (a) Overload and short circuit protection must be provided for electric circuits and components in accordance with [Secs. 75.518](#) and [75.518-1](#) of this part;
- (b) Each electric conductor from the battery to the starting motor must be protected against short circuit by fuses or other circuit-interrupting devices placed as near as practicable to the battery terminals;
- (c) Each branch circuit conductor connected to the main circuit between the battery and charging generator must be protected against short circuit by fuses or other automatic circuit-interrupting devices;
- (d) The electrical system shall be equipped with a circuit-interrupting device by means of which all power conductors can be de-energized. The device must be located as close as practicable to the battery terminals and be designed to operate within its electrical rating without damage. The device shall not automatically reset after being actuated. All magnetic circuit-interrupting devices must be mounted in a manner to preclude their closing by force of gravity;
- (e) Each motor and charging generator must be protected by an automatic overcurrent device. One protective device will be acceptable when two motors of the same rating operate simultaneously and perform virtually the same duty;
- (f) Each ungrounded conductor must have insulation compatible with the impressed voltage. Insulation materials must be resistant to deterioration from engine heat and oil. Electric conductors must meet the applicable requirements of [Secs. 75.513](#) and [75.513-1](#), except electric conductors for starting motors, which must only meet the requirements of [Sec. 75.513](#);
- (g) All wiring must have adequate mechanical protection to prevent damage to the cable that might result in short circuits;
- (h) Sharp edges and corners must be removed at all points where there is a possibility of damaging wires, cables, or conduits by cutting or abrasion. The insulation of the cables within a battery box must be protected against abrasion;
- (i) When insulated wires other than cables pass through metal frames, the holes must be substantially bushed with insulated bushings. Cables must enter metal frames of motors, splice boxes, and electric components only through proper fittings. All electrical connections and splices must be mechanically and electrically efficient, and suitable connectors shall be used. All electrical connectors or splices in insulated wire must be reinsulated at least to the same degree of protection as the remainder of the wire;
- (j) The battery must be secured to prevent movement and must be protected from external damage by position. Batteries that are not protected from external damage by position must be enclosed in a battery box. Flame-resistant insulation treated to resist chemical reaction to electrolyte must be provided on battery connections to prevent battery terminals from contacting conducting surfaces;
- (k) A battery box, including the cover, must be constructed of steel with a minimum thickness of $\frac{1}{8}$ inch, or of a material other than steel that provides equivalent strength;

- (l) Battery-box covers must be lined with a flame-resistant insulating material permanently attached to the underside of the cover, unless equivalent protection is provided. Battery-box covers must be provided with a means for securing them in closed position. At least ^{1/2} inch of air space must be provided between the underside of the cover and the top of the battery, including terminals;
- (m) Battery boxes must be provided with ventilation openings to prevent the accumulation of flammable or toxic gases or vapors within the battery box. The size and locations of openings for ventilation must prevent direct access to battery terminals;
- (n) The battery must be insulated from the battery-box walls and supported on insulating materials. Insulating materials that may be subject to chemical reaction with electrolyte must be treated to resist such action; and
- (o) Drainage holes must be provided in the bottom of each battery box.

30 CFR § 75.1911

Fire suppression systems for diesel-powered equipment and fuel transportation units.

- (a) The fire suppression system required by [Secs. 75.1907](#) and [75.1909](#) shall be a multipurpose dry chemical type (ABC) fire suppression system listed or approved by a nationally recognized independent testing laboratory and appropriate for installation on diesel-powered equipment and fuel transportation units.
 - (1) The system shall be installed in accordance with the manufacturer's specifications and the limitations of the listing or approval.
 - (2) The system shall be installed in a protected location or guarded to minimize physical damage from routine vehicle operations.
 - (3) Suppressant agent distribution tubing or piping shall be secured and protected against damage, including pinching, crimping, stretching, abrasion, and corrosion.
 - (4) Discharge nozzles shall be positioned and aimed for maximum fire suppression effectiveness. Nozzles shall also be protected against the entrance of foreign materials such as mud, coal dust, or rock dust.
- (b) The fire suppression system shall provide fire suppression and, if automatic, fire detection for the engine including the starter, transmission, hydraulic pumps and tanks, fuel tanks, exposed brake units, air compressors and battery areas on diesel-powered equipment and electric panels or controls used on fuel transportation units and other areas as necessary.
- (c) If automatic, the fire suppression system shall include audible and visual alarms to warn of fires or system faults.
- (d) The fire suppression system shall provide for automatic engine shutdown. If the fire suppression system is automatic, engine shutdown and discharge of suppressant agent may be delayed for a maximum of 15 seconds after the fire is detected by the system.
- (e) The fire suppression system shall be operable by at least two manual actuators. One actuator shall be located on each side of the equipment. If the equipment is provided with an operator's compartment, one of the manual actuators shall be located in the compartment within reach of the operator.

- (f) The fire suppression system shall remain operative in the event of engine shutdown, equipment electrical system failure, or failure of any other equipment system.
- (g) The electrical components of each fire suppression system installed on equipment used where permissible electric equipment is required shall be permissible or intrinsically safe and such components shall be maintained in permissible or intrinsically safe condition.
- (h) Electrically operated detection and actuation circuits shall be monitored and provided with status indicators showing power and circuit continuity. If the system is not electrically operated, a means shall be provided to indicate the functional readiness status of the detection system.
- (i) Each fire suppression system shall be tested and maintained in accordance with the manufacturer's recommended inspection and maintenance program and as required by the nationally recognized independent testing laboratory listing or approval, and be visually inspected at least once each week by a person trained to make such inspections.
- (j) Record keeping Persons performing inspections and tests of fire suppression systems under paragraph (i) shall record when a fire suppression system does not meet the installation or maintenance requirements of this section.
 - (1) The record shall include the equipment on which the fire suppression system did not meet the installation or maintenance requirements of this section, the defect found, and the corrective action taken.
 - (2) Records are to be kept manually in a secure manner not susceptible to alteration or recorded electronically in a secured computer system that is not susceptible to alteration.
 - (3) Records shall be maintained at a surface location at the mine for one year and made available for inspection by an authorized representative of the Secretary and miners' representatives.
- (k) All miners normally assigned to the active workings of the mine shall be instructed about the hazards inherent to the operation of the fire suppression systems and, where appropriate, the safeguards available for each system.
- (l) For purposes of [Sec. 75.380\(f\)](#), a fire suppression system installed on diesel-powered equipment and meeting the requirements of this section is equivalent to a fire suppression system meeting the requirements of Secs. 75.1107-3 through 75.1107-16.

30 CFR § 75.1912

Fire suppression systems for permanent underground diesel fuel storage facilities.

- (a) The fire suppression system required by [Sec. 75.1903](#) shall be an automatic multipurpose dry chemical type (ABC) fire suppression system listed or approved as an engineered dry chemical extinguishing system by a nationally recognized independent testing laboratory and appropriate for installation at a permanent underground diesel fuel storage facility.
 - (1) Alternate types of fire suppression systems shall be approved in accordance with [Sec. 75.1107-13](#) of this part.
 - (2) The system shall be installed in accordance with the manufacturer's specifications and the limitations of the listing or approval.

- (3) The system shall be installed in a protected location or guarded to prevent physical damage from routine operations.
 - (4) Suppressant agent distribution tubing or piping shall be secured and protected against damage, including pinching, crimping, stretching, abrasion, and corrosion.
 - (5) Discharge nozzles shall be positioned and aimed for maximum fire suppression effectiveness in the protected areas. Nozzles must also be protected against the entrance of foreign materials such as mud, coal dust, and rock dust.
- (b) The fire suppression system shall provide automatic fire detection and automatic fire suppression for all areas within the facility.
 - (c) Audible and visual alarms to warn of fire or system faults shall be provided at the protected area and at a surface location which is continually monitored by a person when personnel are underground. In the event of a fire, personnel shall be warned in accordance with the provisions set forth in [Sec. 75.1101-23](#).
 - (d) The fire suppression system shall de-energize all power to the diesel fuel storage facility when actuated except that required for automatic enclosure and alarms.
 - (e) Fire suppression systems shall include two manual actuators located as follows:
 - (1) At least one within the fuel storage facility; and
 - (2) At least one a safe distance away from the storage facility and located in intake air, upwind of the storage facility.
 - (f) The fire suppression system shall remain operational in the event of electrical system failure.
 - (g) Electrically operated detection and actuation circuits shall be monitored and provided with status indicators showing power and circuit continuity. If the system is not electrically operated, a means shall be provided to indicate the functional readiness status of the detection system.
 - (h) Each fire suppression system shall be tested and maintained in accordance with the manufacturer's recommended inspection and maintenance program and as required by the nationally recognized independent testing laboratory listing or approval, and be visually inspected at least once each week by a person trained to make such inspections.
 - (i) Record keeping. Persons performing inspections and tests of fire suppression systems under paragraph (h) shall record when a fire suppression system does not meet the installation or maintenance requirements of this section.
 - (1) The record shall include the facility whose fire suppression system did not meet the installation or maintenance requirements of this section, the defect found, and the corrective action taken.
 - (2) Records are to be kept manually in a secure manner not susceptible to alteration or recorded electronically in a secured computer system that is not susceptible to alteration.
 - (3) Records shall be maintained at a surface location at the mine for one year and made available for inspection by an authorized representative of the Secretary and miners' representatives.

- (j) All miners normally assigned to the active workings of the mine shall be instructed about the hazards inherent to the operation of the fire suppression systems and, where appropriate, the safeguards available for each system.

30 CFR § 75.1913

Starting aids.

- (a) Volatile fuel starting aids shall be used in accordance with recommendations provided by the starting aid manufacturer, the engine manufacturer, and the machine manufacturer.
- (b) Containers of volatile fuel starting aids shall be conspicuously marked to indicate the contents. When not in use, containers of volatile fuel starting aids shall be stored in metal enclosures that are used only for storage of starting aids. Such metal enclosures must be conspicuously marked, secured, and protected from damage.
- (c) Volatile fuel starting aids shall not be:
 - (1) Taken into or used in areas where permissible equipment is required;
 - (2) Used in the presence of open flames or burning flame safety lamps, or when welding or cutting is taking place; or
 - (3) Used in any area where 1.0 percent or greater concentration of methane is present.
- (d) Compressed oxygen or compressed flammable gases shall not be connected to diesel air-start systems.

30 CFR § 75.1914

Maintenance of diesel-powered equipment.

- (a) Diesel-powered equipment shall be maintained in approved and safe condition or removed from service.
- (b) Maintenance and repairs of approved features and those features required by [Secs. 75.1909](#) and [75.1910](#) on diesel-powered equipment shall be made only by a person qualified under [Sec. 75.1915](#).
- (c) The water scrubber system on diesel-powered equipment shall be drained and flushed, by a person who is trained to perform this task, at least once on each shift in which the equipment is operated.
- (d) The intake air filter on diesel-powered equipment shall be replaced or serviced, by a person who is trained to perform this task, when the intake air pressure drop device so indicates or when the engine manufacturer's maximum allowable air pressure drop level is exceeded.
- (e) Mobile diesel-powered equipment that is to be used during a shift shall be visually examined by the equipment operator before being placed in operation. Equipment defects affecting safety shall be reported promptly to the mine operator.
- (f) All diesel-powered equipment shall be examined and tested weekly by a person qualified under [Sec. 75.1915](#).

- (1) Examinations and tests shall be conducted in accordance with approved checklists and manufacturers' maintenance manuals.
 - (2) Persons performing weekly examinations and tests of diesel-powered equipment under this paragraph shall make a record when the equipment is not in approved or safe condition. The record shall include the equipment that is not in approved or safe condition, the defect found, and the corrective action taken.
- (g) Undiluted exhaust emissions of diesel engines in diesel-powered equipment approved under part 36 and heavy-duty nonpermissible diesel-powered equipment as defined in [Sec. 75.1908\(a\)](#) in use in underground coal mines shall be tested and evaluated weekly by a person who is trained to perform this task. The mine operator shall develop and implement written standard operating procedures for such testing and evaluation that specify the following:
- (1) The method of achieving a repeatable loaded engine operating condition for each type of equipment;
 - (2) Sampling and analytical methods (including calibration of instrumentation) that are capable of accurately detecting carbon monoxide in the expected concentrations;
 - (3) The method of evaluation and interpretation of the results;
 - (4) The concentration or changes in concentration of carbon monoxide that will indicate a change in engine performance. Carbon monoxide concentration shall not exceed 2500 parts per million; and
 - (5) The maintenance of records necessary to track engine performance.
- (h) Record keeping. Records required by paragraphs (f)(2) and (g)(5) shall be:
- (1) Recorded in a secure book that is not susceptible to alteration, or recorded electronically in a computer system that is secure and not susceptible to alteration; and
 - (2) Retained at a surface location at the mine for at least 1 year and made available for inspection by an authorized representative of the Secretary and by miners' representatives.
- (i) Diesel-powered equipment must be maintained in accordance with this part as of November 25, 1997.

30 CFR § 75.1915

Training and qualification of persons working on diesel- powered equipment.

- (a) To be qualified to perform maintenance, repairs, examinations and tests on diesel-powered equipment, as required by [Sec. 75.1914](#), a person must successfully complete a training and qualification program that meets the requirements of this section. A person qualified to perform these tasks shall be retrained as necessary to maintain the ability to perform all assigned diesel-powered equipment maintenance, repairs, examinations and tests.
- (b) A training and qualification program under this section must:
 - (1) Be presented by a competent instructor;

- (2) Be sufficient to prepare or update a person's ability to perform all assigned tasks with respect to diesel-powered equipment maintenance, repairs, examinations and tests;
 - (3) Address, at a minimum, the following:
 - (i) The requirements of subpart T of this part;
 - (ii) Use of appropriate power package or machine checklists to conduct tests to ensure that diesel-powered equipment is in approved and safe condition, with acceptable emission levels;
 - (iii) Proper maintenance of approved features and the correct use of the appropriate maintenance manuals, including machine adjustments, service, and assembly;
 - (iv) Diesel-powered equipment fire suppression system tests and maintenance;
 - (v) Fire and ignition sources and their control or elimination, including cleaning of the equipment;
 - (vi) Safe fueling procedures and maintenance of the fuel system of the equipment; and
 - (vii) Intake air system maintenance and tests.
 - (4) Include an examination that requires demonstration of the ability to perform all assigned tasks with respect to diesel-powered equipment maintenance, repairs, examinations and tests; and
 - (5) Be in writing. The written program shall include a description of the course content, materials, and teaching methods for initial training and retraining.
- (c) Record keeping. The operator shall maintain a copy of the training and qualification program required by this section and a record of the names of all persons qualified under the program.
- (1) The record of the names of qualified persons shall be made in a manner that is not susceptible to alteration, or recorded electronically in a computer system that is secure and not susceptible to alteration.
 - (2) The training and qualification program and record of qualified persons are to be kept at surface location of the mine and made available for inspection by an authorized representative of the Secretary and by miners' representatives.

30 CFR § 75.1916

Operation of diesel-powered equipment.

- (a) Diesel-powered equipment shall be operated at a speed that is consistent with the type of equipment being operated, roadway conditions, grades, clearances, visibility, and other traffic.
- (b) Operators of mobile diesel-powered equipment shall maintain full control of the equipment while it is in motion.
- (c) Standardized traffic rules, including speed limits, signals and warning signs, shall be established at each mine and followed.

- (d) Except as required in normal mining operations, mobile diesel-powered equipment shall not be idled.
- (e) Diesel-powered equipment shall not be operated unattended.

Electrical Retraining

1998

Paul R. Fuller

Diesel Generator Sets

Underground

Although the use of Diesel Generated Power Substations and Power Centers to continuously supply power for mine electrical systems has declined and, today, rarely used, there are basic requirements for these systems which must be complied with by statutory provision. Deviation from the statutory provisions must have a granted 101(c) Petition for Modification in order to be used in the manner which **is on the increase**.

This increased use is to provide power for portable mobile equipment on the surface of mines and in the process of relocating pieces of electrical equipment underground, i.e., changing equipment from section to section.

Although there are several other requirements in setting up a diesel electric power system, the following are those requirements that are related to the application of running or operating a diesel electrical power system underground. The first portion is for background information.

- I. Unit requirements as per 30 CFR 75.701 and 77.701.
 - A. Metallic frames, casings, and other enclosures of electric equipment that can become “alive” through failure of insulation or by contact with energized parts shall be grounded by methods approved by an authorized representative of the Secretary.
- II. Unit requirements as per 30 CFR 75.901 and 77.901
 - A. Low and medium-voltage three-phase alternating current circuits used underground shall contain either a direct or derived **neutral which shall be grounded through a suitable resistor at the power center; and a grounding circuit, originating at the “grounded side” of the grounding resistor, shall extend along with the power conductors and serve as a grounding conductor for the frames of all the electrical equipment supplies power from that circuit.** The only exception is that the Secretary or his authorized representative may permit ungrounded low-and medium-voltage circuits to be used underground to feed such stationary electrical equipment if such circuits are either steel armored or installed in grounded rigid steel conduit throughout their entire length.
 - B. In addition, 77.901(c) requires that “low-and medium-voltage circuits supplying power to three-phase alternating current stationary electric equipment shall comply with the National Electric Code.”
 - C. Definitions by the National Electric Code:

1. Grounded: Means connected to the earth or to some conducting body which serves in place of the earth. Article 100
2. Grounded Conductor: A system or circuit conductor which is intentionally grounded. Article 100
3. Grounding Conductor: A conductor used to connect equipment or the grounding circuit of a wiring system to a grounding electrode or electrodes. Article 100
4. Grounding Electrode: Underground metallic media to attach one or more grounding conductors. Article 250-81, Article 250-82 & Article 250-83
5. Installation: Electrodes should, as far as practicable, be imbedded below permanent moisture level. Except where rock bottom is encountered, pipes or rods shall be driven to a depth of 8 feet, regardless of size or number of electrodes used. Article 250-83
6. Resistance: Made electrodes shall, where practicable, have a resistance to ground not to exceed 25 ohms. Where the resistance is not as low as 25 ohms, two or more electrodes connected in parallel shall be used. Article 250-84

III. The requirements for generators, with regard to the items in Item I and Item II, when supplying power to the underground area of a mine from a surface substation.

A. Provided with a **low resistance ground field to earth**; a grounding conductor from the ground field attached to the grounded side of the grounding resistor; and, extending along the power conductor to be used as a frame ground for electric equipment.

B. Section 75.700-1, Approved methods of grounding:

1. A solid connection to a borehole casing have **low resistance to earth**.
2. A solid connection to metal waterlines having **low resistance to earth**.
3. A solid connection to a ****grounding conductor**, "other than the neutral conductor of a resistance grounded system," "extending" to a **low resistance ground field** located on the surface.
4. Any other method of grounding, approved by an authorized representative of the Secretary which **ensures that there is no difference in potential** between such metallic enclosures and **the earth**.

IV. The requirements for generators, being used underground, with regard to the items in Item I and Item II, when supplying power to off-board, portable, or mobile electric equipment underground.

A. Must be provided with a grounding conductor attached to the grounded side of the grounding resistor, attached to a low resistance grounding medium to earth, or by a

method approved by the Secretary or by an authorized representative of the Secretary.
Sources: 30 CFR plus the NEC & IEEE referencing generators.

- B. Must be provided with a circuit breaker which will open the circuit to the generator prior to reaching the maximum available short circuit current.

V. The purpose of the diesel generator set:

- A. As the main power source, to provide an electric power source for all electric equipment at a mine site, in lieu of a substation or utility-supplied power.
- B. Supply power to electric equipment in areas where it is difficult, or not cost effective, to run cables.
- C. Move electric face equipment, section equipment, from one section to another, or to start a new section.
- D. Operate certain pieces of electric equipment while the installation of a permanent power source is in progress.

VIII. Requirements for gen sets used underground:

- A. The same as Item I and Item II, if there is no granted 101(c) Petition for Modification
- B. Must be provided with a circuit breaker which will de-energize the power from electric equipment prior to reaching the maximum available short circuit current.

IX. **Alternative Method.** In many cases, it is difficult to impracticable to even attempt to ground the frame of the generator to a low resistance grounding medium due to the distance involved in attaching a grounding conductor in the manner the law prescribes. i.e., 30 CFR cannot be complied with in relation to the above two sections. Without discussing the actual hazards of not providing a frame ground for the generator, Sections 701 and 901 of the surface and underground law **must** be “modified” when **legally** using a generator to move equipment over a distance longer than the equipment trailing cables, or, extremely long and large grounding conductors must be used. An acceptable alternate method, although, not necessarily the only alternate method, is as follows:

- A. Low current (typically 90 milliamps, or less) ground fault protection circuits, for the frame of the generator should a breakdown in insulation occur causing power to appear on the generator frame, in lieu of a grounding conductor to a low resistance grounding medium, as afforded by a granted 101(c) Petition for Modification.
- B. Circuit diagram for generator systems with granted 101(c) Petitions for Modification with general requirements.
- C. Must be provided with a circuit breaker which will de-energized the power circuit prior to the maximum available short circuit current being reached: **and, shut off the generator in the event that a phase to ground fault should occur to the generator frame.**
- C. **Open for discussion!**

DEPARTMENT OF MINES, MINERALS AND ENERGY

Board of Coal Mining Examiners

4 VAC 25-20-10 et seq. Board of Coal Mining Examiners Certification Requirements.

Statutory Authority: §§ 45.1-161.28, 45.1-161.29, 45.1-161.34 and 45.1-161.35 of the Code of Virginia.

Effective Date: August 20, 1997.

CHAPTER 20.

BOARD OF COAL MINING EXAMINERS CERTIFICATION REQUIREMENTS.

PART 1.

GENERAL AND SPECIFIC REQUIREMENTS FOR CERTIFICATION

4 VAC 25-20-10. (Repealed.)

4 VAC 25-20-15. Definitions.

- A. This chapter works with the Virginia Mine Safety Act, Title 45.1 of the Code of Virginia. Refer to §45.1-161.for other definitions related to this chapter.
- B. The following words and terms, when used in this chapter, shall have the following meaning unless the context clearly indicates otherwise:

“Appropriately related work experience” means work experience which demonstrates the applicant’s skill and level of responsibility in performing tasks, and prepares and equips him to perform in the capacity of a certified person.

“BCME” means Board of Coal Mining Examiners.

“Chief” means the Chief of the Division of Mines.

“DMME” means the Department of Mines, Minerals and Energy.

“Division” means the Division of Mines.

“DMLR” means Division of Mined Land Reclamation

“EMT” means emergency medical technician.

“GCM” means general coal miner.

“MSHA” means the Mine Safety and Health Administration

“Virginia coal mine safety regulations” mean 4 VAC 25-50-10 through 4 VAC 25-120-10.

“Virginia Mine Safety Act” means Chapters 14.2 (§ 45.1-161.7 et. seq.) through 14.6 (§ 45.1-161.304 et seq.) and Chapter 18 (§ 45.1-221 et seq.) of Title 45.1 of the Code of Virginia.

4 VAC 25-20-20. General requirements.

- A. Applicants shall submit the Application for Certification Examination, Form DM-BCME-1.
- B. Applicants shall submit the Verification of Work Experience Form DM-BCME-2 and documentation of experience for approval by the chief if required for the certification. This information shall be signed by a company official knowledgeable of the experience of the applicant and shall be notarized.
- C. Applicants shall submit a valid standard or advanced first aid certificate or card, first responder card, MSHA Form 5000-23 with the new miner training or annual refresher portion completed, or Emergency Medical Technician certification except where noted. First aid shall be a component of training and examination for all certifications issued by the BCME.
- D. Applicants shall submit documentation of all degrees, continuing education, and other training if required for certification.
- E. Applicants shall submit a \$ 10 fee to take each examination or to retake all or part of an examination. Refer to § 45.1-161.31 of the Code of Virginia for acceptable forms of payment.
- F. The Application for Certification Examination and the applicable fees shall be submitted at least five working days prior to the examination.
- G. Applicants shall fulfill the requirements of this section and accumulate the required years of experience no later than five years after passing the examination.
- H. Those applicants not meeting the requirements of subsection G of this section shall begin the application process again, submitting a new application, taking the examination again, and paying the fee. A work experience form shall only be submitted if the applicant needs to update information.
- I. Certificate holders shall notify the division office within 90 days of a change in their name, their mailing address, or the status of any certification required by this chapter. Failure to do so may prevent the division from notifying the certificate holder of the certification requirements. The last known address reported to the division will be used to mail notices and information.
- J. The division shall mail notices to certificate holders which state the deadline for completion of requirements and the conditions under which the certificate may be suspended or revoked.

4 VAC 25-20-30. Examination requirements.

- A. Applicants for first class mine foreman, surface foreman, surface blaster, and underground shot firer certifications shall score at least 85% on each section of the written examination. Applicants for all other certifications shall score at least 80% on each section of the written examination.

- B. If all or part of an examination is failed, then the applicant shall wait at least 10 working days after the notification letter has been sent before retaking the failed section or sections.
- C. If a section of the examination is failed a second time, then the applicant shall wait at least 10 working days after the notification letter has been sent before retaking the entire examination.
- D. If the examination is failed on the third try, then the applicant shall wait the greater of one year from the date of the first examination or 10 working days after the notification letter has been sent before he may begin the examination cycle again.
- E. If one year passes prior to the third take of the examination, the certification cycle shall start over with a new application, fee, and examination. A work experience form shall only be submitted if the applicant needs to update information.
- F. An examination may not be taken more than three times in one year.
- G. Applicants for certifications shall also pass the gas detection examination unless already certified in gas detection, except as noted in the certification requirements in Part II (4 VAC 25-50-50 et seq.) of this chapter.

4 VAC 25-20-40. Requirements for reciprocity.

- A. Reciprocity shall be available for persons certified by states which accept the corresponding Virginia certifications and show certification requirements are substantially equivalent to Virginia's.
- B. If reciprocity is requested by a person certified in another state which accepts the corresponding Virginia certification, a current copy of the pocket card or certificate and documentation from the other state shall be submitted in addition to fulfilling the requirements in 4 VAC 25-20-20.
- C. Applicants for a surface blaster certification shall pass any other examinations required by the DMLR with a score of at least 85% and meet any corresponding DMLR requirements.

4 VAC 25-20-45. Approval of continuing education programs and sponsors.

- A. Colleges, universities, training companies, manufacturers, operators, other organizations and persons who wish to sponsor a continuing education program shall submit information to the chief which explains how their program will meet the requirements outlined in this chapter. The request shall include a description of the proposed training, the instructor's name and certification numbers, and the tentative schedule and location. Applicants approved to provide training shall notify the division of the final schedule as soon as is practical.
- B. Applicants who wish to have continuing education approved for credit shall submit information to the chief which explains how the training they attended meets the requirements outlined in this chapter. The request shall include a description of the training, the instructors name and certification numbers, and the date time and location of the training.

- C. The chief shall notify the applicant in writing of his decision to approve or disapprove the training.

PART II
CERTIFICATION REQUIREMENTS

4 VAC 25-20-50. First class mine foreman.

- A. Applicants shall possess five years of mining experience, three of which shall be underground, and shall pass the first class mine foreman, map, and gas detection examinations.
- B. Applicants shall be given three years of credit for a degree in mining engineering from an approved four-year college or two years of credit for a degree in mining technology.
- C. Applicants shall be at least 23 years of age.
- D. Beginning August 20, 1997, certified mine foremen shall complete the continuing education requirements in this section within two years from the date of their certification and every two years thereafter. The holder of the certificate shall submit documentation to the division indicating the required continuing education has been completed prior to these deadlines.
- E. The holder of the certificate, in order to receive continuing education credit, shall satisfactorily complete a first class mine foreman continuing education course approved by the chief and taught by a certified instructor or other instructor approved by the chief.
- F. The first class mine foreman shall complete at least four hours of continuing education every two years.
- G. The content of the continuing education course shall include, but is not limited to, the:
 - 1. Coal Mine Safety Act, Chapter 14.2 (§ 45.1-161.7 et seq.) of Title 45.1 of the Code of Virginia;
 - 2. Virginia coal mine safety regulations;
 - 3. Responsibilities of first class mine foreman;
 - 4. Virginia coal mine safety policies and division operators' memos; and
 - 5. Review of fatalities and accident trends in Virginia underground coal mines.
- H. A maximum of four hours in excess of the required hours may be carried over to the next continuing education period.
- I. Failure to complete continuing education requirements shall result in suspension of a person's certification pending completion of continuing education. If the continuing education requirement is not met within two years from the suspension date, the certification shall be revoked by the BCME.

- J. The division shall send notice of any suspension to the last address the certified person reported to the division in accordance with 4 VAC 25-20-20 1 and to the last employer's address reported to the division.

4 VAC 25-20-60. First class shaft or slope foreman.

- A. Applicants shall possess five years of mining work experience at a shaft or slope, or appropriately related work experience approved by the chief.
- B. Applicants shall pass the first class shaft or slope foreman and gas detection examinations.
- C. Applicants may be given three years of credit for a degree in mining engineering or two years of credit for a degree in mining technology.

4 VAC 25-20-70. Surface foreman.

- A. Applicants shall possess five years of surface coal mining experience.
- B. Applicants shall pass the surface foreman, first aid, and gas detection examinations.
- C. Beginning August 20, 1997, certified persons shall complete the continuing education requirements in this section within two years from the date of their certification and every two years thereafter. The holder of the certificate shall submit documentation to the division indicating the required continuing education has been completed prior to these deadlines.
- D. The holder of the certificate, in order to receive continuing education credit, shall satisfactorily complete a surface foreman continuing education course approved by the chief and taught by a certified instructor or other instructor approved by the chief.
- E. The surface foreman shall complete at least four hours of continuing education every two years.
- F. The content of the continuing education shall include, but is not limited to, the:
 - 1. Coal Mine Safety Act, Chapter 14.2 (§ 45.1-161.7 et seq.) of Title 45.1 of the Code of Virginia;
 - 2. Virginia coal mine safety regulations;
 - 3. Responsibilities of surface foreman;
 - 4. Virginia coal mine safety policies and division operators' memos; and
 - 5. Review of fatalities and accident trends in Virginia surface coal mines.
- G. A maximum of four hours in excess of the required hours may be carried over to the next continuing education period.

- H. Failure to complete continuing education requirements shall result in suspension of a person's certification pending completion of continuing education. If the continuing education requirement is not met within two years from the suspension date, the certification shall be revoked by the BCME.
- I. The division shall send notice of any suspension to the last known address of the certified person reported to the division in accordance with 4 VAC 25-20-20 1 and to the last employer's address reported to the division.

4 VAC 25-20-90. Underground shot firer.

- A. Applicants shall possess two years of coal mining experience underground, one year of the two years shall have included handling and using explosives underground under the direction of a certified underground shot firer, or appropriately related work experience approved by the chief.
- B. Applicants shall pass the underground shot firer and gas detection examination.

4 VAC 25-20-100. Underground electrical repairman.

- A. Applicants shall possess one year of electrical experience in underground coal mining under the direction of a certified underground electrical repairman or appropriately related work experience approved by the chief.
- B. Applicants shall pass the underground electrical repairman and gas detection examinations.
- C. Applicants may be given six months of credit for electrical educational training from a college, technical school, or vocational school.
- D. Applicants who are certified may perform electrical work at underground and surface locations.
- E. Continuing education requirements.
 - 1. An underground electrical repairman certification shall remain valid if the certified person meets the MSHA annual retraining requirements (30 CFR 75.153(g)).
 - 2. Submission of a copy of documentation sent to MSHA shall be acceptable to meet this requirement.
 - 3. If a certificate expires because the certificate holder fails to complete the retraining requirements, then the holder of the expired certificate shall meet requirements of Part 1 (4 VAC 25-20-10 et seq.) of this chapter and pass the surface electrical repairman examination prior to reinstatement of certification by the board.

4 VAC 25-20-120. Electrical maintenance foreman (surface and underground).

- A. Applicants shall hold a valid electrical repairman certification prior to being eligible to take the appropriate electrical maintenance foreman examination and shall pass the appropriate electrical maintenance foreman examination.
- B. Applicants shall possess three years of electrical experience as applied to underground mining or appropriately related work experience approved by the chief.
- C. Applicants may be given one year of credit for an electrical engineering degree, or six months of credit for electrical education training from a technical or vocational school.
- D. Applicants who become certified may perform electrical work at surface and underground locations.
- E. Applicants must meet continuing education requirements in subsection E of 4 VAC 25-20-100 for an electrical repairman.

4 VAC 25-20-125. Electrical maintenance foreman (surface).

- A. Applicants shall hold a valid electrical repairman certification prior to being eligible to take the appropriate electrical maintenance foreman examination and shall pass the electrical maintenance foreman examination.
- B. Applicants shall possess three years of electrical experience as applied to surface mining or appropriately related work experience approved by the chief.
- C. Applicants may be given one year of credit for an electrical engineering degree, or six months of credit for electrical education training from a technical or vocational school.
- D. Applicants who become certified may perform electrical work at surface locations only.
- E. Applicants must meet continuing education requirements in subsection E of 4 VAC 25-20-100 for an electrical repairman.

4 VAC 25-20-129. Chief electrician (surface and underground).

- A. Applicants shall hold a valid electrical repairman and electrical maintenance foreman certification prior to being eligible to take the chief electrician examination and shall pass the appropriate chief electrician examination.
- B. Applicants shall possess five years of electrical experience, or appropriately related work experience approved by the chief, and shall meet continuing education requirements in subsection E of 4 VAC 25-20-100 for an electrical repairman.
- C. Applicants who become certified may perform electrical work at surface and underground locations.

4 VAC 25-20-130. Chief electrician (surface).

- A. Applicants shall hold a valid electrical repairman and electrical maintenance foreman certification prior to being eligible to take the chief electrician examination and shall pass the appropriate chief electrician examination.
- B. Applicants shall possess five years of electrical experience, or appropriately related work experience approved by the chief, and shall meet continuing education requirements in subsection E of 4 VAC 25-20-100 for an electrical repairman.
- C. Applicants who become certified may perform electrical work at surface locations only.

4 VAC 25-20-140. Hoisting engineer.

- A. Applicants shall possess two years of practical mining experience and one year of hoisting experience under the direction of a certified hoisting engineer, or appropriately related work experience approved by the chief. A certified hoisting engineer shall verify the hoisting experience.
- B. The applicant shall pass the hoisting engineer and gas detection examinations.
- C. After the examination has been successfully completed, the applicant shall obtain written permission from a mine official to have a representative from the division observe the applicant's operation of hoisting equipment at the mine. Permission shall be on company stationery, signed by the company official, and submitted to the division.
- D. A certified hoisting engineer may act as an automatic elevator operator after completing the on-site demonstration required by 4 VAC 25-20-240 C.

4 VAC 25-20-150. Top person.

- A. Applicants shall possess one year of practical mining experience with at least 30 days under the direction of a certified top person, or appropriately related work experience approved by the chief.
- B. Applicants shall pass the top person, first aid, and gas detection examinations.
- C. This certification shall not be used in lieu of any other certification.

4 VAC 25-20-160. Preparation plant foreman.

- A. Applicants shall possess five years coal mining experience, at least one year shall be at a preparation plant, or appropriately related work experience approved by the chief.
- B. Applicants shall pass the preparation plant foreman and gas detection examinations.
- C. Applicants may be given three years of credit for a degree in mining engineering or two years of credit for a degree in mining technology.

4 VAC 25-20-170. Dock foreman.

- A. Applicants shall possess five years coal mining experience, at least one year shall be at a preparation plant, or appropriately related work experience approved by the chief.
- B. Applicants shall pass dock foreman and gas detection examinations.
- C. This certification shall not be used in lieu of any other certification.

4 VAC 25-20-180. Mine Inspector.

- A. Applicants shall possess mining experience as described in § 45.1-161.20 of the Code of Virginia.
- B. Applicants shall be given three years of credit for a degree in mining engineering from an approved four-year college.
- C. Applicants shall hold a valid First Class Mine Foreman Certificate.
- D. Applicants shall meet the continuing education requirements of 4 VAC 25-20-50 for first class mine foreman.
- E. Applicants shall pass the mine inspector examination.
- F. A certificate will not be issued until an applicant is employed by the DMME and shall only remain valid while the person is employed by the department.

4 VAC 25-20-190. Underground diesel engine mechanic.

- A. All maintenance work performed on diesel engines used to power equipment in underground coal mines shall be performed by, or under the direct supervision of, a person possessing a Diesel Engine Mechanic Certificate issued by the BCME. In addition, no operator of an underground coal mine in the Commonwealth of Virginia may use diesel-powered equipment in the mine without first employing a diesel engine mechanic who is certified by the BCME.
- B. "Maintenance" shall include all of the tasks required to be performed routinely to ensure that the engine exhaust emissions conform with the requirements of the laws and regulations of Virginia and MSHA, and with the maintenance recommendations of the manufacturer of the engine.
- C. Applicants shall possess six months of experience as a diesel engine mechanic, complete a diesel engine mechanic course approved by the division, or possess appropriately related work experience approved by the chief. A one-year diesel engine mechanic program approved by the division may be substituted for the diesel engine mechanic experience.
- D. Applicants shall pass the underground diesel engine mechanic, first aid, and gas detection examinations.

- E. The initial training course for diesel engine mechanics shall include at least 32 hours of classroom instruction and be taught by a certified instructor.
- F. To qualify for approval by the chief, the content of the initial training course for diesel engine mechanics shall include, but is not limited to:
 - 1. Diesel engine principles;
 - 2. Diesel fuel and fuel systems;
 - 3. Engine exhaust systems;
 - 4. State and federal diesel laws and regulations;
 - 5. Safe use of equipment;
 - 6. Emission controls, testing procedures, and recordkeeping; and
 - 7. Protection of health of workers exposed to diesel equipment.
- G. The annual continuing education course for diesel engine mechanics shall include at least four hours of classroom instruction and be taught by a certified instructor.
- H. The content of the continuing education course shall include, but not be limited to:
 - 1. Diesel technology;
 - 2. State and federal diesel laws and regulations;
 - 3. Safe use of equipment;
 - 4. Protection of the health of workers exposed to diesel equipment; and
 - 5. Required emission test procedures and recordkeeping.
- I. A Diesel Engine Mechanic Certificate shall remain valid until December 31 following the anniversary date of the initial training, providing the certification requirements are met, unless the certificate is revoked by the BCME.
- J. The holder of the certificate shall renew the certificate by satisfactorily completing a diesel engine mechanic continuing education course approved by the chief and taught by a certified instructor.
- K. The holder of the certificate shall submit documentation to the division indicating the required continuing education has been completed before the expiration of the card.
- L. Failure to complete the required education shall result in suspension of certification pending completion of continuing education. If the continuing education requirement is not met within two years from the suspension date, then the certification shall be revoked by the BCME.

- M. The division shall send notice of any suspension to the last known address that the certified person reported to the division in accordance with 4 VAC 25-20-20 1 and to the last known employer address.

4 VAC 25-20-200. Diesel engine mechanic instructor.

- A. Applicants shall have teaching experience and be a certified diesel engine mechanic or possess appropriately related work experience approved by the chief.
- B. Applicants shall maintain the certificate by teaching at least one approved diesel engine mechanic course every two years or at least one approved diesel engine mechanic continuing education course every year.
- C. Documentation shall be submitted to the division indicating the required teaching has been completed.
- D. Failure to complete the required teaching shall result in suspension of the certification. Applicants may meet the teaching requirement by teaching under the supervision of a certified diesel mechanic engine instructor. If the teaching requirement is not met one year from suspension, then the certification shall be revoked by the BCME.
- E. The division shall send notice of any suspension to the last known address that the certified person reported to the division in accordance with 4 VAC 25-20-20 1 and to the last known employer's address.

4 VAC 25-20-210. Advanced first aid.

- A. Applicants shall complete a 24-hour advanced first aid class, at minimum, taught by a certified advanced first aid instructor, or possess appropriately related work experience approved by the chief and pass the advanced first aid examination.
- B. Approved advanced first aid classes shall cover the following subjects:
 - 1. Introduction to first aid;
 - 2. Respiratory emergencies and cardiopulmonary resuscitation; i.e., heart saver or other four-hour equivalent;
 - 3. Removal of foreign bodies from the throat (the Heimlich Maneuver);
 - 4. Wounds;
 - 5. Shock;
 - 6. Specific injuries including head and chest;
 - 7. Contamination, infection, and prevention;
 - 8. Burns;

9. Cold exposure and frost bite;
 10. Bone and joint injuries;
 11. Dressings and bandages;
 12. Sudden illness;
 13. Emergency underground rescue and transfer;
 14. Unusual rescue situations related to mining;
 15. Poisoning, toxic and hazardous materials;
 16. Transportation of victims; and
 17. Heat exposure.
- C. Certified persons shall complete four hours of continuing education annually, which is taught by a certified advanced first aid instructor, to maintain their advanced first aid card. This continuing education requirement shall include re-certification in CPR.
- D. The holder of the certificate shall submit documentation to the division indicating the required continuing education has been completed.
- E. Applicants holding a valid EMT card or EMT first responder card shall be deemed eligible to receive advanced first aid certification without having to complete the initial advanced first aid class or without passing the advanced first aid examination. All applicants shall complete eight hours of continuing education. The advanced first aid certification shall start on the day the applicant's EMT certification or EMT first responder certification expires.
- F. Failure to complete required continuing education shall result in suspension of the certification pending completion of the continuing education. If the continuing education requirement is not met within one year from the suspension date, the certification shall be revoked by the BCME.
- G. The division shall send notice of any suspension to the last known address of the certified person reported to the division in accordance with 4 VAC 25-20-20 1 and to the last known employer address.

4 VAC 25-20-220. Advanced first aid instructor.

- A. Applicants shall be certified as an advanced first aid instructor by the American Red Cross, National Safety Council, Virginia Emergency Medical Services, or as otherwise approved by the chief. Applicants shall also be certified in cardiopulmonary resuscitation by the American Heart Association of the American Red Cross.

- B. The holder of the certificate shall submit documentation to the division indicating that they have continued their certification as required by subsection A of this section or by teaching one initial or refresher first aid training course for DMME within a two-year period.
- C. Failure to maintain a certified advanced first aid instructor's certification will result in suspension of the applicant's BCME certification. Applicants may meet the teaching requirement by teaching under the supervision of an advanced first aid instructor. If the certification is not renewed within one year from the suspension date, the certification shall be revoked by the BCME.
- D. The division shall send notice of any suspension to the last known address of the certified person reported to the division in accordance with 4 VAC 25-20-20 1 and the last known address of the employer.

4 VAC 25-20-230. Surface facilities foreman for shops, labs, and warehouses.

- A. Applicants shall possess one year of work experience at a shop, lab, or warehouse or appropriately related work experience approved by the chief.
- B. Applicants shall pass the surface facilities foreman and gas detection examinations.
- C. This certification shall not be used in lieu of any other certification.

4 VAC 25-20-240. Automatic elevator operator.

- A. Applicants shall possess one year of mining experience or appropriately related work experience approved by the chief.
- B. Applicants shall pass the automatic elevator operator and gas detection examinations.
- C. The applicant shall obtain written permission from a mine official to have a representative from the division observe the applicant's operation of an automatic elevator at the mine. Permission shall be on company stationery, signed by the company official, and submitted to the division prior to the scheduled observation. The applicant shall demonstrate proper use of the equipment.

4 VAC 25-20-250. Gas detection qualification.

- A. The applicant shall demonstrate the proper use of gas detection equipment and shall pass the gas detection examination.
- B. The general requirements of 4 VAC 25-20-20 shall not apply except the applicants shall complete Form DM-BCME-1.

4 VAC 25-20-255. General coal miner (GCM) surface and underground.

- A. Applicants employed in Virginia coal mines prior to January 1, 1996, who wish to become certified shall:
1. Meet the requirements of Part 1 (4VAC 25-20-10 et seq.) of this chapter.
 2. Complete training which shall include highlights of the coal mine safety laws of Virginia and the underground coal mine safety and health regulations of the division and the BCME. The training shall address surface mining requirements for the GCM Surface Certification or underground coal mining requirements for the GCM Underground Certification. The training shall include a demonstration of knowledge or passing of a written examination on Virginia's coal mine safety laws and regulations covering either surface or underground mining. First aid shall be included in the general coal miner training unless applicants submit new miner training or annual refresher training to meet first aid requirements.
 3. Submit Form DM-BCME-3, Verification of Training Completed for General Coal Miner Certification, prior to commencing work in a coal mine. The form shall be signed by the employee and the instructor and the date they sign will be the effective date of the General Coal Miner certification.
 4. Pass the gas detection examination unless working only on the surface of a mine.

4 VAC 25-20-259. BCME Instructor.

- A. Instructors conducting training used to meet requirements of the BCME shall be certified unless otherwise approved in this chapter.
- B. To become a certified instructor, the person shall:
1. Submit an application showing applicable mining or instructor experience.
 2. Agree to monitoring and evaluation by division instructors and demonstrate the knowledge, skill, and ability to conduct training.
- C. Final approval for certification shall be based on an evaluation of performance.
- D. Applicants shall maintain the certificate by teaching at least one approved certification course every two years.
- E. The holder of the certificate shall submit documentation to the division indicating the required teaching has been completed.
- F. Failure to recertify shall result in suspension of the certification pending completion of the required teaching. Applicants may meet the teaching requirement by teaching under the supervision of a certified instructor. If the teaching requirement is not met within one year from the suspension date, then the certification shall be revoked by the BCME.
- G. The division shall send notice of any suspension to the last known address of the certified person reported to the division in accordance with 4 VAC 25-20-20 1 and to the last known employer address.

PART III
CERTIFICATION REQUIREMENTS FOR MINERAL MINING
(Repealed.)

4 VAC 25-20-260. (Repealed)

4 VAC 25-20-270. (Repealed)

4 VAC 25-20-280. (Repealed)

4 VAC 25-20-290. (Repealed)

4 VAC 25-20-300. (Repealed)

4 VAC 25-20-310. (Repealed)

4 VAC 25-20-320. (Repealed)

4 VAC 25-20-330. (Repealed)

PART IV
ON-SITE EXAMINATION OF MINE FOREMAN

4 VAC 25-20-340. Examinations.

- A. When a mine is issued a closure order or violation related to a hazardous roof or ventilation condition, the mine foreman may be examined to determine his knowledge of the roof control plan and ventilation requirements in the area of his responsibility at the mine. The examination shall be conducted on the surface at the mine site on the day the violation or closure order is issued.
- B. The chief shall develop a pool of no more than 50 questions addressing the areas listed in subsection D of this section, which shall be approved by the BCME. These questions shall be available on request and should be incorporated as part of continuing education and other training for mine foremen.
- C. A division inspector shall administer a written examination using 10 questions from the approved pool. The foreman shall answer eight out of 10 questions correctly to demonstrate thorough understanding of the mine's roof or ventilation plans. The inspector shall select questions from the pool which are most relevant to the conditions or practices resulting in the order of closure or violation.
- D. The mine foreman may refer to roof control, ventilation, bleeder, or other plans available to him when examined at the surface of an underground mine. Any mine foreman performing tasks requiring certification or otherwise directing work in ventilation or roof support shall be able to provide the following information:
 - 1. Describe the roof control requirements set out in the mine's roof control plan in the area of the foreman's responsibility.

2. Describe the frequency and methods of any required testing of roof, face, and ribs in the area of the foreman's responsibility.
 3. Show how the roof control practices in the area of the foreman's responsibility comply with the requirements of the roof control plan.
 4. Describe the frequency and contents of any pre-shift, on-shift, and when applicable, weekly examinations of mine ventilation required in the area of the foreman's responsibility.
 5. Describe the requirements for action under the mine's fan stoppage plan in the area of the foreman's responsibility.
 6. Describe any requirements for face ventilation controls used in the area of the foreman's responsibility.
 7. Describe any requirements under the mine bleeder plan in the area of the foreman's responsibility.
 8. Describe the requirements for mine ventilation controls such as regulators, ventilation doors, and other similar controls in the area of the foreman's responsibility.
 9. Describe the minimum volume of air required in the area of the foreman's responsibility.
 10. Describe the minimum requirements for quality of air (oxygen, carbon dioxide, and methane) in the area of the foreman's responsibility.
 11. Describe the procedure to follow in the area of the foreman's responsibility upon an accumulation of methane at:
 - a. 1.0% or greater not less than 12 inches from the roof, face, ribs, or floor;
 - b. Greater than 1.0% in a split that ventilates any group of active areas;
 - c. 1.5% (or 2.0% as applicable) in a split of air returning from areas where coal is being extracted or is capable of being extracted; or
 - d. 5.0% or greater in any area of the mine.
- E. The division inspector completing an examination of a foreman under this part shall discuss the results of the exam with the foreman before leaving the mine.

4 VAC 25-20-350. Actions brought before the BCME.

- A. The examination shall be the basis of any enforcement action brought before the board for failure to display a thorough understanding of the roof control plan and ventilation for the area of the mine for which he is responsible.
- B. Refusal of the foreman to submit to examination will constitute just cause to be brought before the board and may result in suspension of certification and revocation of certification by the board.

PART V. GUIDELINES FOR ON-SITE EXAMINATION OF A MINE FOREMAN

4 VAC 25-20-360. Purpose and scope.

- A. Section 45.1-161.35 A of the Code of Virginia provides for on-site examination of a mine foreman by a mine inspector to determine that the foreman has a thorough understanding of the roof control plan and ventilation or the area of the mine for which he is responsible. The procedures followed by the inspector in conducting an on-site examination of a mine foreman must be consistent with requirements in Part IV (4 VAC 25-20-340 et seq.) of this chapter. This includes the use of questions approved by the board which are administered in accordance with this chapter.
- B. The purpose of examining a mine foreman is to measure and evaluate his knowledge and understanding of mine roof control and ventilating or the areas of his responsibility. Mine foreman are required to demonstrate this and other elements of mine safety when they become certified to act as mine foremen in the Commonwealth of Virginia.
- C. On-site examination by the mine inspector will only be initiated where there is just cause that the foreman has failed to maintain safe roof control and ventilation for his area of responsibility at the mine. Just cause for on-site examination of a mine foreman by a mine inspector must be based on issuance of an order of closure or violation related to a hazardous condition pertaining to roof control or ventilation.

4 VAC 25-20-370. Determination by the inspector to conduct an on-site examination.

- A. An order of closure issued in accordance with § 45.1-161.91 of the Code of Virginia, or notice of violation issued in accordance with § 45.1-161.90 of the Code of Virginia that relate to roof control or ventilation hazards, shall be reviewed at the time it is issued for evidence of mine foreman negligence, which could require on-site examination of the mine foreman by the mine inspector. In making the determination whether or not to conduct an on-site examination, the mine inspector must establish the following:
 - 1. The roof or ventilation hazards cited resulted from performing his duties with less than ordinary care. Ordinary care means the use of such care as a reasonably prudent and careful mine foreman could use under similar circumstances.
 - 2. The mine foreman knew or should have known of the existence of the hazardous condition.

- B. When these criteria have been established, the mine inspector will undertake an on-site examination of the mine foreman.

4 VAC 25-20-380. Notification of intent to conduct an on-site examination.

- A. The mine inspector will notify the mine foreman of an order of closure or notice of violation for a hazardous condition related to roof control or ventilation in the area of the foreman's responsibility. The inspector will let him know that he intends to invoke the provision of the law for an on-site examination of the foreman.
- B. The following approach will be taken by the mine inspector in giving notice to the mine foreman.
 - 1. The notification will be given by the inspector in private.
 - 2. The inspector will be courteous and professional in explaining the reason for the on-site examination.
 - 3. The inspector will explain the procedures he will follow in conducting the on-site examination.

4 VAC 25-20-390. Procedures for conducting on-site examination.

- A. The on-site examination of the mine foreman will be handled in such a way as to not prevent the foreman from performing his duties. The on-site examination must be conducted, to the extent possible, immediately on arrival, outside on the surface, on the day the order of closure or notice of violation is issued.
- B. These procedures will be followed in conducting the on-site examination:
 - 1. The examination will be administered in a written format.
 - 2. Ten questions selected by the mine inspector will be written out by the mine inspector on paper for use in the on-site examination.
 - 3. The mine inspector will choose the 10 questions from the approved pool.
 - 4. The mine inspector will choose the 10 questions related to the condition or practice being cited by the order of closure or notice of violation.
 - 5. The mine foreman will be provided sufficient time to write out his answers to the questions. He may refer to plans or other information available to him. However, no other person may assist him in answering the questions. The mine inspector will remain with the mine foreman during the written examination.
 - 6. The mine inspector will read the questions being asked to the mine foreman if requested and should answer any questions from the mine foreman which could help to clarify his understanding of the questions.

7. The mine foreman may respond to the questions orally. In this case, the mine inspector will record the response of the mine foreman to each question of the examination form, have the foreman sign the form as accurately representing the response, and provide the mine foreman a copy promptly upon completion.

4 VAC 25-20-400. Results of the on-site examination.

- A. The mine inspector will promptly check the responses given by the mine foreman for each of the 10 questions asked. At least eight of the 10 questions must be answered correctly to successfully complete the on-site examination. The results of the on-site examination will be reviewed promptly with the mine foreman. A copy of the written on-site examination completed by the mine foreman will be provided to him promptly by the mine inspector.
- B. The circumstances related to the on-site examination of the mine foreman, including pass or fail results, will be described in the inspector's report and will be reviewed as part of the closeout of the scheduled inspection activity for the mine.
- C. The chief will notify the mine foreman and mine operator in writing of the petition to the BCME for a formal hearing. Should a petition for a hearing be requested, the hearing would be conducted in accordance with part VI (4 VAC 25-20-410 et. seq.) of this chapter.
- D. If a foreman successfully appeals a violation which resulted in an on-site evaluation and further established to the BCME that he had a thorough knowledge of such plans, then the failure of the on-site examination shall not be used in any other revocation against the foreman.

PART VI HEARING PROCEDURES

4 VAC 25-20-410. Prehearing procedures.

- A. Any person wishing to bring any matter before the board shall use these procedures except for good cause shown before the board.
- B. Petitions for action by the board shall be in writing, shall state the grounds for the petition before the board, shall state the relief sought, and shall include any applicable supporting material, as set out below:
 1. For certification to be revoked in accordance with § 45.1-161.35 B of the Code of Virginia, the petitioner or petitioners shall submit specific charges which set forth the reasons why the certification should be revoked.
 2. To request a reexamination for a certificate revoked pursuant to § 45.1-161.35 of the Code of Virginia, the holder of the revoked certificate shall submit a request for reexamination with evidence that the cause for revocation of his certificate has ceased to exist.

3. For other petitions before the board, the petitioner shall submit a written petition explaining the request being made and the relief being sought.
- C. The division shall assign a docket number to all petitions before the boards. The division shall provide written notice to all parties to any proceeding in accordance with § 45.1-161.35 D of the Code of Virginia and the Administration Process Act (§ 9-6.14:1 et seq. of the Code of Virginia).
- D. Persons wishing to address the board, except those making a petition for board action, will be provided an opportunity at the conclusion of the board meeting.
- E. Persons shall make any request for change to the board's regulations in accordance with the DMME and the board's Public Participation Guidelines, 4 VAC 25-10-10 et seq.

4 VAC 25-20-420. Conduct of formal hearings.

- A. All hearings shall be heard during scheduled meetings of the board, on a case-by-case basis, in the order the petitions appear on the docket.
- B. Hearings shall be held in the DMME, Big Stone Gap office, unless a different location is agreed to by mutual consent of the parties to the hearing and the Chairman of the BCME.
- C. Hearings requiring case decisions shall be recorded.
- D. Each party may be represented by an individual of choice or legal counsel.
- E. The chairman, with the concurrence of the majority of the board present at a hearing, shall have the authority to limit evidence to that relevant to the issues. Any proofs, rebuttal, and cross examination which are immaterial, insubstantial, privileged, or repetitive may be excluded.
- F. The chairman may continue, adjourn, and reconvene the hearing as necessary.
- G. Decisions of the board shall be made based on a preponderance of the evidence placed before it.

4 VAC 25-20-430. Post hearing procedures.

- A. The board may require submittal of briefs from the parties to a hearing concerning the issues of record before the board. The board shall schedule submittal of briefs at the time of the hearing.
- B. Transcripts of the proceeding shall be provided on request to any party to the hearing at cost. Motions to correct any transcript shall be filed within 10 working days after delivery of the transcript and shall be ruled on by the chief within 10 working days after his receipt of the motion. Any corrections shall be sent to all parties to the hearing who have received a copy of the transcript.
- C. Decisions shall be rendered in writing and communicated to parties to the proceeding in accordance with the Administration Process Act (§ 9-6.14:1 et seq. of the Code of Virginia).

**VIRGINIA BOARD OF COAL MINING
EXAMINERS
CERTIFICATION REQUIREMENTS**

VIRGINIA DEPARTMENT OF MINES, MINERALS AND ENERGY

CHAPTER 20

BOARD OF COAL MINING EXAMINERS CERTIFICATION REQUIREMENTS

Research and Practice References

54 Am Jur 2d, Mines and Minerals §§148 (development and operation--in general), 167-170, 173-176 (development and operation--public control and regulation--in general).

Part I

General and Specific Requirements for Certification

4VAC25-20-10. [Repealed]

Historical Notes

Derived from VR480-04-2 §1.1; eff. June 30, 1994; repealed, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Editor's Note

This section provided for administration of certification and continuing education programs.

4VAC25-20-15. Definitions.

A. This chapter works with the Virginia Mine Safety Act, Title 45.1 of the Code of Virginia. Refer to [§45.1-161.8](#) for other definitions related to this chapter.

B. The following words and terms, when used in this chapter, shall have the following meaning unless the context clearly indicates otherwise:

"Appropriately related work experience" means work experience which demonstrates the applicant's skill and level of responsibility in performing tasks, and prepares and equips him to perform in the capacity of a certified person.

"BCME" means Board of Coal Mining Examiners.

"Chief" means the Chief of the Division of Mines.

"DMME" means the Department of Mines, Minerals and Energy.

"Division" means the Division of Mines.

"DMLR" means Division of Mined Land Reclamation.

"EMT" means emergency medical technician.

"GCM" means general coal miner.

"MSHA" means the Mine Safety and Health Administration.

"Virginia coal mine safety regulations" mean 4VAC25-50-10 et seq. through 4VAC25-120-10 et seq.

"Virginia Mine Safety Act" means Chapters 14.2 (§[45.1-161.7](#) et seq.) through 14.6 (§[45.1-161.304](#) et seq.) and Chapter 18 (§45.1-221 et seq.) of Title 45.1 of the Code of Virginia.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

4VAC25-20-20. General requirements.

- A. Applicants shall submit the Application for Certification Examination, Form DM-BCME-1.
- B. Applicants shall submit the Verification of Work Experience Form DM-BCME-2 and documentation of experience for approval by the chief if required for the certification. This information shall be signed by a company official knowledgeable of the experience of the applicant and shall be notarized.
- C. Applicants shall submit a valid standard or advanced first aid certificate or card, first responder card, MSHA Form 5000-23 with the new miner training or annual refresher portion completed, or Emergency Medical Technician Certification except where noted. First aid shall be a component of training and examination for all certifications issued by the BCME.
- D. Applicants shall submit documentation of all degrees, continuing education, and other training if required for certification.
- E. Applicants shall submit a \$10 fee to take each examination or to retake all or part of an examination. Refer to §[45.1-161.31](#) of the Code of Virginia for acceptable forms of payment.
- F. The Application for Certification Examination and the applicable fees shall be submitted at least five working days prior to the examination.
- G. Applicants shall fulfill the requirements of this section and accumulate the required years of experience no later than five years after passing the examination.
- H. Those applicants not meeting the requirements of subsection G of this section shall begin the application process again, submitting a new application, taking the examination again, and paying the fee. A work experience form shall only be submitted if the applicant needs to update information.
- I. Certificate holders shall notify the division office within 90 days of a change in their name, their mailing address, or the status of any certification required by this chapter. Failure to do so may prevent the division from notifying the certificate holder of the certification requirements. The last known address reported to the division will be used to mail notices and information.
- J. The division shall mail notices to certificate holders which state the deadline for completion of requirements and the conditions under which the certificate may be suspended or revoked.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §1.2; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

4VAC25-20-30. Examination requirements.

- A. Applicants for first class mine foreman, surface foreman, surface blaster, and underground shot firer certifications shall score at least 85% on each section of the written examination. Applicants for all other certifications shall score at least 80% on each section of the written examination.
- B. If all or part of an examination is failed, then the applicant shall wait at least 10 working days after the notification letter has been sent before retaking the failed section or sections.
- C. If a section of the examination is failed a second time, then the applicant shall wait at least 10 working days after the notification letter has been sent before retaking the entire examination.
- D. If the examination is failed on the third try, then the applicant shall wait the greater of one year from the date of the first examination or 10 working days after the notification letter has been sent before he may begin the examination cycle again.
- E. If one year passes prior to the third take of the examination, the certification cycle shall start over with a new application, fee, and examination. A work experience form shall only be submitted if the applicant needs to update information.
- F. An examination may not be taken more than three times in one year.
- G. Applicants for certifications shall also pass the gas detection examination unless already certified in gas detection except as noted in the certification requirements in Part II (4VAC25-20-50 et seq.) of this chapter.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §1.3; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment clarified when a work experience form is necessary and made grammatical and technical changes.

4VAC25-20-40. Requirements for reciprocity.

- A. Reciprocity shall be available for persons certified by states which accept the corresponding Virginia certifications and whose certification requirements are substantially equivalent to Virginia's.
- B. If reciprocity is requested by a person certified in another state which accepts the corresponding Virginia certification, a current copy of the pocket card or certificate, and documentation from the other state shall be submitted in addition to fulfilling the requirements in 4VAC25-20-20.
- C. Applicants for a surface blaster certification shall pass any other examinations required by the DMLR with a score of at least 85% and meet any corresponding DMLR requirements.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §1.4; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment deleted the requirement of subsection B that grades be submitted; deleted former subsection C, which required applicants to score at least 85% on the Virginia exam; relettered former subsection D as C and inserted "for a surface blaster certification" after "Applicants" in that subsection; and made technical changes.

4VAC25-20-45. Approval of continuing education programs and sponsors.

- A. Colleges, universities, training companies, manufacturers, operators, other organizations, and persons who wish to sponsor a continuing education program shall submit information to the chief which explains how their program will meet the requirements outlined in this chapter. The request shall include a description of the proposed training, the instructor's name and certification numbers, and the tentative schedule and location. Applicants approved to provide training shall notify the division of the final schedule as soon as is practical.
- B. Applicants who wish to have continuing education approved for credit shall submit information to the chief which explains how the training they attended meets the requirements outlined in this chapter. The request shall include a description of the training, the instructor's name and certification numbers, and the date, time and location of the training.
- C. The chief shall notify the applicant in writing of his decision to approve or disapprove the training.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Part II Certification Requirements

4VAC25-20-50. First class mine foreman.

- A. Applicants shall possess five years of mining experience, three of which shall be underground, and shall pass the first class mine foreman, map, and gas detection examinations.
- B. Applicants shall be given three years of credit for a degree in mining engineering from an approved four-year college or two years of credit for a degree in mining technology.
- C. Applicants shall be at least 23 years of age.
- D. Beginning August 20, 1997, certified mine foremen shall complete the continuing education requirements in this section within two years from the date of their certification and every two years thereafter. The holder of the certificate shall submit documentation to the division indicating the required continuing education has been completed prior to these deadlines.
- E. The holder of the certificate, in order to receive continuing education credit, shall satisfactorily complete a first class mine foreman continuing education course approved by the chief and taught by a certified instructor or other instructor approved by the chief.
- F. The first class mine foreman shall complete at least four hours of continuing education every two years.
- G. The content of the continuing education course shall include, but is not limited to, the:
 - 1. Coal Mine Safety Act, Chapter 14.2 ([§45.1-161.7](#) et seq.) of Title 45.1 of the Code of Virginia;
 - 2. Virginia coal mine safety regulations;
 - 3. Responsibilities of first class mine foreman;
 - 4. Virginia coal mine safety policies and division operators' memos; and
 - 5. Review of fatalities and accident trends in Virginia underground coal mines.
- H. A maximum of four hours in excess of the required hours may be carried over to the next continuing education period.
- I. Failure to complete continuing education requirements shall result in suspension of a person's certification pending completion of continuing education. If the continuing education requirement is not met within two years from the suspension date, the certification shall be revoked by the BCME.
- J. The division shall send notice of any suspension to the last address the certified person reported to the division in accordance with 4VAC25-20-20 I and to the last employer's address reported to the division.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.1; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment changed subsection A by deleting "or appropriately related work experience approved by the Division of Mines" after "underground," and by adding "and shall pass the first class mine foreman, map, and gas detection examinations"; changed "may" to "shall" in subsection B; and added subsections D to J.

4VAC25-20-60. First class shaft or slope foreman.

- A. Applicants shall possess five years of mining work experience at a shaft or slope or appropriately related work experience approved by the chief.
- B. Applicants shall pass the first class shaft or slope foreman and gas detection examinations.
- C. Applicants may be given three years of credit for a degree in mining engineering or two years of credit for a degree in mining technology.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.2; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment redesignated former subsection B as C; added new subsection B; and changed "Division of Mines" to "chief" in subsection A.

4VAC25-20-70. Surface foreman.

- A. Applicants shall possess five years of surface coal mining experience.
- B. Applicants shall pass the surface foreman, first aid, and gas detection examinations.
- C. Beginning August 20, 1997, certified persons shall complete the continuing education requirements in this section within two years from the date of their certification and every two years thereafter. The holder of the certificate shall submit documentation to the division indicating the required continuing education has been completed prior to these deadlines.

- D. The holder of the certificate, in order to receive continuing education credit, shall satisfactorily complete a surface foreman continuing education course approved by the chief and taught by a certified instructor or other instructor approved by the chief.
- E. The surface foreman shall complete at least four hours of continuing education every two years.
- F. The content of the continuing education course shall include, but is not limited to, the:
 - 1. Coal Mine Safety Act, Chapter 14.2 (§[45.1-161.7](#) et seq.) of Title 45.1 of the Code of Virginia;
 - 2. Virginia coal mine safety regulations;
 - 3. Responsibilities of surface foreman;
 - 4. Virginia coal mine safety policies and division operators' memos; and
 - 5. Review of fatalities and accident trends in Virginia surface coal mines.
- G. A maximum of four hours in excess of the required hours may be carried over to the next continuing education period.
- H. Failure to complete continuing education requirements shall result in suspension of a person's certification pending completion of continuing education. If the continuing education requirement is not met within two years from the suspension date, the certification shall be revoked by the BCME.
- I. The division shall send notice of any suspension to the last known address of the certified person reported to the division in accordance with 4VAC25-20-20 I and to the last employer's address reported to the division.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.3; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment substantially revised this section.

4VAC25-20-80. Surface blaster.

- A. Applicants shall possess one year of blasting experience on a surface mine under the direction of a certified surface blaster or appropriately related work experience approved by the chief.
- B. Applicants shall pass the surface blaster examination and the endorsement section of the examination required by the DMLR and meet any corresponding DMLR requirements in 4VAC25-130-850.14. The gas detection examination is not required.

C. Certified surface blasters must be recertified in accordance with the DMLR requirements in 4VAC25-130-850.15. To remain certified, a blaster shall be recertified every five years by:

1. Presenting written proof that he has demonstrated blasting competency in his work during two of the last three years immediately preceding the expiration date; or
2. Retaking and passing the mined land reclamation portion of the blaster exam.

D. An applicant who fails the exam shall complete the training required by DMLR regulations in 4VAC25-130-850.13 and pass the coal surface blaster's exam prior to recertification.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.4; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment substantially revised subsections A and B; and added subsections C and D dealing with recertification.

4VAC25-20-90. Underground shot firer.

A. Applicants shall possess two years of coal mining experience underground, one year of the two years shall have included handling and using explosives underground under the direction of a certified underground shot firer, or appropriately related work experience approved by the chief.

B. Applicants shall pass the underground shot firer and gas detection examinations.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.5; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment changed subsection A by inserting "coal" before "mining", inserting "under the direction of a certified underground shot firer", and replacing "Division of Mines" with "chief"; and added subsection B.

4VAC25-20-100. Underground electrical repairman.

- A. Applicants shall possess one year of electrical experience in underground coal mining under the direction of a certified underground electrical repairman or appropriately related work experience approved by the chief.
- B. Applicants shall pass the underground electrical repairman and gas detection examinations.
- C. Applicants may be given six months of credit for electrical educational training from a college, technical school, or vocational school.
- D. Applicants who are certified may perform electrical work at underground and surface locations.
- E. Continuing education requirements.
 - 1. An underground electrical repairman certification shall remain valid if the certified person meets the MSHA annual retraining requirements (30 CFR 75.153(g)).
 - 2. Submission of a copy of documentation sent to MSHA shall be acceptable to meet this requirement.
 - 3. If a certificate expires because the certificate holder fails to complete the electrical retraining requirements, then the holder of the expired certificate shall meet requirements of Part I (4VAC25-20-10 et seq.) of this chapter and pass the electrical repairman examination prior to reinstatement of certification by the board.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.6; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment substantially revised subsection A; added new subsection B and redesignated former subsection B as C; and added subsections D and E.

4VAC25-20-110. Surface electrical repairman.

- A. Applicants shall possess one year of electrical experience in surface coal mining under the direction of a certified surface electrical repairman or appropriately related work experience approved by the chief.
- B. Applicants shall pass the surface electrical repairman and gas detection examinations.
- C. Applicants may be given six months of credit for electrical educational training from a college, technical school, or vocational school.
- D. Applicants who are certified may perform electrical work at surface locations only.
- E. Continuing education requirements.

1. A surface electrical repairman certification shall remain valid if the certified person meets the MSHA annual electrical retraining requirements (30 CFR 75.153(g)).
2. Submission of a copy of documentation sent to MSHA shall be acceptable to meet this requirement.
3. If a certificate expires because the certificate holder fails to complete the retraining requirements, then the holder of the expired certificate shall meet requirements of Part I (4VAC25-20-10 et seq.) of this chapter and pass the surface electrical repairman examination prior to reinstatement of certification by the board.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.7; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment substantially revised subsection A; added new subsection B and redesignated former subsection B as C; and added subsections D and E.

4VAC25-20-120. Electrical maintenance foreman (surface and underground).

- A. Applicants shall hold a valid electrical repairman certification prior to being eligible to take the appropriate electrical maintenance foreman examination and shall pass the appropriate electrical maintenance foreman examination.
- B. Applicants shall possess three years of electrical experience as applied to underground mining or appropriately related work experience approved by the chief.
- C. Applicants may be given one year of credit for an electrical engineering degree, or six months of credit for electrical education training from a technical or vocational school.
- D. Applicants who become certified may perform electrical work at surface and underground locations.
- E. Applicants must meet continuing education requirements in subsection E of 4VAC25-20-100 for an electrical repairman.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.8; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment substantially revised subsections A and D; replaced "Division of Mines" with "chief" in subsection B; and added subsection E.

4VAC25-20-125. Electrical maintenance foreman (surface).

- A. Applicants shall hold a valid electrical repairman certification prior to being eligible to take the appropriate electrical maintenance foreman examination and shall pass the electrical maintenance foreman examination.
- B. Applicants shall possess three years of electrical experience as applied to surface mining or appropriately related work experience approved by the chief.
- C. Applicants may be given one year of credit for an electrical engineering degree, or six months of credit for electrical education training from a technical or vocational school.
- D. Applicants who become certified may perform electrical work at surface locations only.
- E. Applicants must meet continuing education requirements in subsection E of 4VAC25-20-100 for an electrical repairman.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

4VAC25-20-129. Chief electrician (surface and underground).

- A. Applicants shall hold a valid electrical repairman and electrical maintenance foreman certification prior to being eligible to take the chief electrician examination and shall pass the appropriate chief electrician examination.
- B. Applicants shall possess five years of electrical experience or appropriately related work experience approved by the chief and shall meet continuing education requirements in subsection E of 4VAC25-20-100 for an electrical repairman.
- C. Applicants who become certified may perform electrical work at surface and underground locations.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

4VAC25-20-130. Chief electrician (surface).

- A. Applicants shall hold a valid electrical repairman and electrical maintenance foreman certification prior to being eligible to take the chief electrician examination and shall pass the appropriate chief electrician examination.
- B. Applicants shall possess five years of electrical experience or appropriately related work experience approved by the chief and shall meet continuing education requirements in subsection E of 4VAC25-20-100 for an electrical repairman.
- C. Applicants who become certified may perform electrical work at surface locations only.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.9; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment substantially revised this section.

4VAC25-20-140. Hoisting engineer.

- A. Applicants shall possess two years of practical mining experience and one year of hoisting experience under the direction of a certified hoisting engineer or appropriately related work experience approved by the chief. A certified hoisting engineer shall verify the hoisting experience.
- B. The applicant shall pass the hoisting engineer and gas detection examinations.
- C. After the examination has been successfully completed, the applicant shall obtain written permission from a mine official to have a representative from the division observe the applicant's operation of hoisting equipment at the mine. Permission shall be on company stationery, signed by the company official, and submitted to the division.
- D. A certified hoisting engineer may act as an automatic elevator operator after completing the on-site demonstration required by 4VAC25-20-240 C.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.10; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment added new subsection B and redesignated former subsection B as C; added subsection D; and made technical changes.

4VAC25-20-150. Top person.

- A. Applicants shall possess one year of practical mining experience with at least 30 days under the direction of a certified top person or appropriately related work experience approved by the chief.
- B. Applicants shall pass the top person, first aid, and gas detection examinations.
- C. This certification shall not be used in lieu of any other certification.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.11; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment added subsections B and C; and replaced "Division of Mines" with "chief" in subsection A.

4VAC25-20-160. Preparation plant foreman.

- A. Applicants shall possess five years of coal mining experience, at least one year shall be at a preparation plant, or appropriately related work experience approved by the chief.
- B. Applicants shall pass the preparation plant foreman and gas detection examinations.
- C. Applicants may be given three years of credit for a degree in mining engineering or two years of credit for a degree in mining technology.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.12; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment added new subsection B and redesignated former subsection B as C; and made technical changes in subsection A.

4VAC25-20-170. Dock foreman.

- A. Applicants shall possess one year of experience at a dock or appropriately related work experience approved by the chief.
- B. Applicants shall pass the dock foreman and gas detection examinations.
- C. This certification shall not be used in lieu of any other certification.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.13; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment replaced "two years" with "one year", and "Division of Mines" with "chief" in subsection A; and added subsections B and C.

4VAC25-20-180. Mine inspector.

- A. Applicants shall possess mining experience as described in §[45.1-161.20](#) of the Code of Virginia.
- B. Applicants shall be given three years of credit for a degree in mining engineering from an approved four-year college.
- C. Applicants shall hold a valid First Class Mine Foreman Certificate.
- D. Applicants shall meet the continuing education requirements of 4VAC25-20-50 for first class mine foreman.
- E. Applicants shall pass the mine inspector examination.
- F. A certificate will not be issued until an applicant is employed by the DMME and shall only remain valid while the person is employed by the department.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.14; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment substantially revised this section.

4VAC25-20-190. Underground diesel engine mechanic.

- A. All maintenance work performed on diesel engines used to power equipment in underground coal mines shall be performed by, or under the direct supervision of, a person possessing a Diesel Engine Mechanic Certificate issued by the BCME. In addition, no operator of an underground coal mine in the Commonwealth of Virginia may use diesel-powered equipment in the mine without first employing a diesel engine mechanic who is certified by the BCME.
- B. "Maintenance" shall include all of the tasks required to be performed routinely to ensure that the engine exhaust emissions conform with the requirements of the laws and regulations of Virginia and MSHA, and with the maintenance recommendations of the manufacturer of the engine.
- C. Applicants shall possess six months of experience as a diesel engine mechanic, complete a diesel engine mechanic course approved by the division, or possess appropriately related work experience approved by the chief. A one-year diesel engine mechanic program approved by the division may be substituted for the diesel engine mechanic experience.
- D. Applicants shall pass the underground diesel engine mechanic, first aid, and gas detection examinations.
- E. The initial training course for diesel engine mechanics shall include at least 32 hours of classroom instruction and be taught by a certified instructor.
- F. To qualify for approval by the chief, the content of the initial training course for diesel engine mechanics shall include, but is not limited to:
1. Diesel engine principles;
 2. Diesel fuel and fuel systems;
 3. Engine exhaust systems;
 4. State and federal diesel laws and regulations;
 5. Safe use of equipment;
 6. Emission controls, testing procedures and record keeping; and
 7. Protection of health of workers exposed to diesel equipment.
- G. The annual continuing education course for diesel engine mechanics shall include at least four hours of classroom instruction and be taught by a certified instructor.
- H. The content of the continuing education course shall include, but not be limited to:
1. Diesel technology;
 2. State and federal diesel laws and regulations;
 3. Safe use of equipment;
 4. Protection of the health of workers exposed to diesel equipment; and
 5. Required emission test procedures and record keeping.

- I. A Diesel Engine Mechanic Certificate shall remain valid until December 31 following the anniversary date of the initial training, providing the certification requirements are met, unless the certificate is revoked by the BCME.
- J. The holder of the certificate shall renew the certificate by satisfactorily completing a diesel engine mechanic continuing education course approved by the chief and taught by a certified instructor.
- K. The holder of the certificate shall submit documentation to the division indicating the required continuing education has been completed before the expiration of the card.
- L. Failure to complete the required education shall result in suspension of certification pending completion of continuing education. If the continuing education requirement is not met within two years from the suspension date, then the certification shall be revoked by the BCME.
- M. The division shall send notice of any suspension to the last known address that the certified person reported to the division in accordance with 4VAC25-20-20 I and to the last known employer's address.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.15; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment added new subsection D and redesignated former subsections D to G as subsections E to H; deleted former subsection H; substantially revised subsection L; and made technical changes throughout.

4VAC25-20-200. Diesel engine mechanic instructor.

- A. Applicants shall have teaching experience and be a certified diesel engine mechanic or possess appropriately related work experience approved by the chief.
- B. Applicants shall maintain the certificate by teaching at least one approved diesel engine mechanic course every two years or at least one approved diesel engine mechanic continuing education course every year.
- C. Documentation shall be submitted to the division indicating the required teaching has been completed.
- D. Failure to complete the required teaching shall result in suspension of the certification. Applicants may meet the teaching requirement by teaching under the supervision of a certified diesel mechanic engine instructor. If the teaching requirement is not met one year from suspension, then the certification shall be revoked by the BCME.

E. The division shall send notice of any suspension to the last known address that the certified person reported to the division in accordance with 4VAC25-20-20 I and to the last known employer's address.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.16; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment substantially revised this section.

4VAC25-20-210. Advanced first aid.

- A. Applicants shall complete a 24-hour advanced first aid class, at minimum, taught by a certified advanced first aid instructor or possess appropriately related work experience approved by the chief and pass the advanced first aid examination.
- B. Approved advanced first aid classes shall cover the following subjects:
 1. Introduction to first aid;
 2. Respiratory emergencies and cardiopulmonary resuscitation; i.e., heart saver or other four-hour equivalent;
 3. Removal of foreign bodies from the throat (the Heimlich Maneuver);
 4. Wounds;
 5. Shock;
 6. Specific injuries including head and chest;
 7. Contamination, infection, and prevention;
 8. Burns;
 9. Cold exposure and frost bite;
 10. Bone and joint injuries;
 11. Dressings and bandages;
 12. Sudden illness;
 13. Emergency underground rescue and transfer;
 14. Unusual rescue situations related to mining;
 15. Poisoning, toxic and hazardous materials;

16. Transportation of victims; and

17. Heat exposure.

- C. Certified persons shall complete four hours continuing education annually, which is taught by a certified advanced first aid instructor, to maintain their advanced first aid card. This continuing education requirement shall include recertification in CPR.
- D. The holder of the certificate shall submit documentation to the division indicating the required continuing education has been completed.
- E. Applicants holding a valid EMT card or EMT first responder card, shall be deemed eligible to receive advanced first aid certification without having to complete the initial advanced first aid class or without passing the advanced first aid examination. All applicants shall complete eight hours of continuing education. The advanced first aid certification shall start on the day the applicant's EMT certification or EMT first responder certification expires.
- F. Failure to complete required continuing education shall result in suspension of the certification pending completion of the continuing education. Applicants may meet the teaching requirement by teaching under the supervision of an advanced first aid instructor. If the continuing education requirement is not met within one year from the suspension date, then the certification shall be revoked by the BCME.
- G. The division shall send notice of any suspension to the last known address of the certified person reported to the division in accordance with 4VAC25-20-20 I and to the last known employer's address.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.17; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment substantially revised subsections A to D; and added subsections E to G.

4VAC25-20-220. Advanced first aid instructor.

- A. Applicants shall be certified as an advanced first aid instructor by the American Red Cross, National Safety Council, Virginia Emergency Medical Services, or as otherwise approved by the chief. Applicants shall also be certified in cardiopulmonary resuscitation by the American Heart Association or the American Red Cross.
- B. The holder of the certificate shall submit documentation to the division indicating that they have continued their certification as required by subsection A of this section or by teaching one initial or refresher first aid training course for DMME within a two-year period.

C. Failure to maintain a certified advanced first aid instructor's certification will result in suspension of the applicant's BCME certification. Applicants may meet the teaching requirement by teaching under the supervision of an advanced first aid instructor. If the certification is not renewed within one year from the suspension date, then the certification shall be revoked by the BCME.

D. The division shall send notice of any suspension to the last known address of the certified person reported to the division in accordance with 4VAC25-20-20 I and the last known address of the employer.

Statutory Authority

§§45.1-161.28, 45.1-161.29, 45.1-161.34 and 45.1-161.35 of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.18; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment substantially revised this section.

4VAC25-20-230. Surface facilities foreman for shops, labs, and warehouses.

A. Applicants shall possess one year of work experience at a shop, lab, or warehouse or appropriately related work experience approved by the chief.

B. Applicants shall pass the surface facilities foreman and gas detection examinations.

C. This certification shall not be used in lieu of any other certification.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.19; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment replaced "Division of Mines" with "chief" in subsection A; deleted former subsection B, which precluded use of this certification in lieu of surface foreman, prep plant foreman or dock foreman certifications; and added new subsections B and C.

4VAC25-20-240. Automatic elevator operator.

- A. Applicants shall possess one year of mining experience or appropriately related work experience approved by the chief.
- B. Applicants shall pass the automatic elevator operator and gas detection examinations.
- C. The applicant shall obtain written permission from a mine official to have a representative from the division observe the applicant's operation of an automatic elevator at the mine. Permission shall be on company stationery, signed by the company official, and submitted to the division prior to the scheduled observation. The applicant shall demonstrate proper use of the equipment.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.20; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment added new subsection B and redesignated former subsection B as C; and made technical changes.

4VAC25-20-250. Gas detection qualification.

- A. The applicant shall demonstrate the proper use of gas detection equipment and shall pass the gas detection examination.
- B. The general requirements of 4VAC25-20-20 shall not apply except that the applicants shall complete Form DM-BCME-1.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from VR480-04-2 §2.21; eff. June 30, 1994.

Amended, Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Effect of Amendment

The August 20, 1997, amendment substantially revised this section.

4VAC25-20-255. General coal miner (GCM) surface and underground.

A. Applicants employed in Virginia coal mines prior to January 1, 1996, who wish to become certified shall:

1. Meet the requirements of Part I (4VAC25-20-10 et seq.) of this chapter;
2. Submit a notarized work experience form verifying mining experience prior to January 1, 1996; and
3. Pass the gas detection examination if they are not already gas detection qualified unless working only on the surface of a mine.

B. Applicants seeking certification after January 1, 1996, shall:

1. Meet the requirements of Part I (4VAC25-20-10 et seq.) of this chapter.
2. Complete training which shall include highlights of the coal mine safety laws of Virginia and the underground coal mine safety and health regulations of the division and the BCME. The training shall address surface mining requirements for the GCM Surface Certification or underground coal mining requirements for the GCM Underground Certification. The training shall include a demonstration of knowledge or passing of a written examination on Virginia's coal mine safety laws and regulations covering either surface or underground mining. First aid shall be included in the general coal miner training unless applicants submit new miner training or annual refresher training to meet first aid requirements.
3. Submit Form DM-BCME-3, Verification of Training Completed for General Coal Miner Certification, prior to commencing work in a coal mine. The form shall be signed by the employee and the instructor, and the date they sign will be the effective date of the General Coal Miner certification.
4. Pass the gas detection examination unless working only on the surface of a mine.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

4VAC25-20-259. BCME instructor.

A. Instructors conducting training used to meet requirements of the BCME shall be certified unless otherwise approved in this chapter.

B. To become a certified instructor, the person shall:

1. Submit an application showing applicable mining or instructor experience.
2. Agree to monitoring and evaluation by division instructors and demonstrate the knowledge, skill, and ability to conduct training.

C. Final approval for certification shall be based on an evaluation of performance.

- D. Applicants shall maintain the certificate by teaching at least one approved certification course every two years.
- E. The holder of the certificate shall submit documentation to the division indicating the required teaching has been completed.
- F. Failure to recertify shall result in suspension of the certification pending completion of the required teaching. Applicants may meet the teaching requirement by teaching under the supervision of a certified instructor. If the teaching requirement is not met within one year from the suspension date, then the certification shall be revoked by the BCME.
- G. The division shall send notice of any suspension to the last known address of the certified person reported to the division in accordance with 4VAC25-20-20 I and to the last known employer's address.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Part III
Certification Requirements for Mineral Mining [Repealed]

4VAC25-20-340. Examinations.

- A. When a mine is issued a closure order or violation related to a hazardous roof or ventilation condition, the mine foreman may be examined to determine his knowledge of the roof control plan and ventilation requirements in the area of his responsibility at the mine. The examination shall be conducted on the surface at the mine site on the day the violation or closure order is issued.
- B. The chief shall develop a pool of no more than 50 questions addressing the areas listed in subsection D of this section, which shall be approved by the BCME. These questions shall be available on request and should be incorporated as part of continuing education and other training for mine foremen.
- C. A division inspector shall administer a written examination using 10 questions from the approved pool. The foreman shall answer eight out of 10 questions correctly to demonstrate thorough understanding of the mine's roof or ventilation plans. The inspector shall select questions from the pool which are most relevant to the conditions or practices resulting in the order of closure or violation.
- D. The mine foreman may refer to roof control, ventilation, bleeder, or other plans available to him when examined at the surface of an underground mine. Any mine foreman performing tasks requiring certification or otherwise directing work in ventilation or roof support shall be able to provide the following information:
 - 1. Describe the roof control requirements set out in the mine's roof control plan in the area of the foreman's responsibility.

2. Describe the frequency and methods of any required testing of roof, face, and ribs in the area of the foreman's responsibility.
 3. Show how the roof control practices in the area of the foreman's responsibility comply with the requirements of the roof control plan.
 4. Describe the frequency and contents of any pre-shift, on-shift, and when applicable, weekly examinations of mine ventilation required in the area of the foreman's responsibility.
 5. Describe the requirements for action under the mine's fan stoppage plan in the area of the foreman's responsibility.
 6. Describe any requirements for face ventilation controls used in the area of the foreman's responsibility.
 7. Describe any requirements under the mine bleeder plan in the area of the foreman's responsibility.
 8. Describe the requirements for mine ventilation controls such as regulators, ventilation doors, and other similar controls in the area of the foreman's responsibility.
 9. Describe the minimum volume of air required in the area of the foreman's responsibility.
 10. Describe the minimum requirements for quality of air (oxygen, carbon dioxide, and methane) in the area of the foreman's responsibility.
 11. Describe the procedure to follow in the area of the foreman's responsibility upon an accumulation of methane at:
 - a. 1.0% or greater not less than 12 inches from the roof, face, ribs, or floor;
 - b. Greater than 1.0% in a split that ventilates any group of active areas;
 - c. 1.5% (or 2.0% as applicable) in a split of air returning from areas where coal is being extracted or is capable of being extracted; or
 - d. 5.0% or greater in any area of the mine.
- E. The division inspector completing an examination of a foreman under this part shall discuss the results of the exam with the foreman before leaving the mine.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

4VAC25-20-350. Actions brought before the BCME.

- A. The examination shall be the basis of any enforcement action brought before the board for failure to display a thorough understanding of the roof control plan and ventilation for the area of the mine for which he is responsible.

- B. Refusal of the foreman to submit to examination will constitute just cause to be brought before the board and may result in suspension of certification and revocation of certification by the board.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

4VAC25-20-360. Purpose and scope.

- A. Section [45.1-161.35](#) A of the Code of Virginia provides for on-site examination of a mine foreman by a mine inspector to determine that the foreman has a thorough understanding of the roof control plan and ventilation for the area of the mine for which he is responsible. The procedures followed by the inspector in conducting an on-site examination of a mine foreman must be consistent with requirements in Part IV (4VAC25-20-340 et seq.) of this chapter. This includes the use of questions approved by the board which are administered in accordance with this chapter.
- B. The purpose of examining a mine foreman is to measure and evaluate his knowledge and understanding of mine roof control and ventilation for the areas of his responsibility. Mine foremen are required to demonstrate this and other elements of mine safety when they become certified to act as mine foremen in the Commonwealth of Virginia.
- C. An on-site examination by the mine inspector will only be initiated when there is just cause that the foreman has failed to maintain safe roof control and ventilation for his area of responsibility at the mine. Just cause for an on-site examination of a mine foreman by a mine inspector must be based on issuance of an order of closure or violation related to a hazardous condition pertaining to roof control or ventilation.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

4VAC25-20-370. Determination by the inspector to conduct an on-site examination.

- A. An order of closure issued in accordance with §[45.1-161.91](#) of the Code of Virginia, or notice of violation issued in accordance with §[45.1-161.90](#) of the Code of Virginia that relate to roof control or ventilation hazards, shall be reviewed at the time it is issued for evidence of mine foreman negligence, which could require on-site examination of the mine foreman by the mine inspector. In making the determination whether or not to conduct an on-site examination, the mine inspector must establish the following:

1. The roof or ventilation hazards cited resulted from performing his duties with less than ordinary care. Ordinary care means the use of such care as a reasonably prudent and careful mine foreman could use under similar circumstances.
 2. The mine foreman knew or should have known of the existence of the hazardous condition.
- B. When these criteria have been established, the mine inspector will undertake an on-site examination of the mine foreman.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

4VAC25-20-380. Notification of intent to conduct an on-site examination.

- A. The mine inspector will notify the mine foreman of an order of closure or notice of violation for a hazardous condition related to roof control or ventilation in the area of the foreman's responsibility. The inspector will let him know that he intends to invoke the provision of the law for an on-site examination of the foreman.
- B. The following approach will be taken by the mine inspector in giving notice to the mine foreman:
1. The notification will be given by the inspector in private.
 2. The inspector will be courteous and professional in explaining the reason for the on-site examination.
 3. The inspector will explain the procedures he will follow in conducting the on-site examination.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

4VAC25-20-390. Procedures for conducting on-site examination.

- A. The on-site examination of the mine foreman will be handled in such a way as to not prevent the foreman from performing his duties. The on-site examination must be conducted, to the extent possible, immediately on arrival, outside on the surface, on the day the order of closure or notice of violation is issued.
- B. These procedures will be followed in conducting the on-site examination:
1. The examination will be administered in a written format.

2. Ten questions selected by the mine inspector will be written out by the mine inspector on paper for use in the on-site examination.
3. The mine inspector will choose the 10 questions from the approved pool.
4. The mine inspector will choose the 10 questions related to the condition or practice being cited by the order of closure or notice of violation.
5. The mine foreman will be provided sufficient time to write out his answers to the questions. He may refer to plans or other information available to him. However, no other person may assist him in answering the questions. The mine inspector will remain with the mine foreman during the written examination.
6. The mine inspector will read the questions being asked to the mine foreman if requested and should answer any questions from the mine foreman which could help to clarify his understanding of the questions.
7. The mine foreman may respond to the questions orally. In this case, the mine inspector will record the response of the mine foreman to each question on the examination form, have the foreman sign the form as accurately representing the response, and provide the mine foreman a copy promptly upon completion.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

4VAC25-20-400. Results of the on-site examination.

- A. The mine inspector will promptly check the responses given by the mine foreman for each of the 10 questions asked. At least eight of the 10 questions must be answered correctly to successfully complete the on-site examination. The results of the on-site examination will be reviewed promptly with the mine foreman. A copy of the written on-site examination completed by the mine foreman will be provided to him promptly by the mine inspector.
- B. The circumstances related to the on-site examination of the mine foreman, including pass or fail results, will be described in the inspector's report, and will be reviewed as part of the closeout of the scheduled inspection activity for the mine.
- C. The chief will notify the mine foreman and mine operator in writing of the petition to the BCME for a formal hearing. Should a petition for a hearing be requested, the hearing would be conducted in accordance with Part VI (4VAC25-20-410 et seq.) of this chapter.
- D. If a foreman successfully appeals a violation which resulted in an on-site evaluation and further establishes to the BCME that he had a thorough knowledge of such plans, then the failure of the on-site examination shall not be used in any other revocation against the foreman.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

Part VI Hearing Procedures

4VAC25-20-410. Prehearing procedures.

- A. Any person wishing to bring any matter before the board shall use these procedures except for good cause shown before the board.
- B. Petitions for action by the board shall be in writing, shall state the grounds for the petition before the board, shall state the relief sought, and shall include any applicable supporting material, as set out below:
 - 1. For certification to be revoked in accordance with §[45.1-161.35](#) B of the Code of Virginia, the petitioner or petitioners shall submit specific charges which set forth the reasons why the certification should be revoked.
 - 2. To request a reexamination for a certificate revoked pursuant to §[45.1-161.35](#) of the Code of Virginia, the holder of the revoked certificate shall submit a request for reexamination with evidence that the cause for revocation of his certificate has ceased to exist.
 - 3. For other petitions before the board, the petitioner shall submit a written petition explaining the request being made and the relief being sought.
- C. The division shall assign a docket number to all petitions before the board. The division shall provide written notice to all parties to any proceeding in accordance with §[45.1-161.35](#) D of the Code of Virginia and the Administrative Process Act (§9-6.14:1 et seq. of the Code of Virginia).
- D. Persons wishing to address the board, except those making a petition for board action, will be provided an opportunity at the conclusion of the board meeting.
- E. Persons shall make any request for change to the board's regulations in accordance with the DMME and the board's Public Participation Guidelines, 4VAC25-10-10 et seq.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

4VAC25-20-420. Conduct of formal hearings.

- A. All hearings shall be heard during scheduled meetings of the board, on a case-by-case basis, in the order the petitions appear on the docket.
- B. Hearings shall be held in the DMME Big Stone Gap office, unless a different location is agreed to by mutual consent of the parties to the hearing and the Chairman of the BCME.
- C. Hearings requiring case decisions shall be recorded.
- D. Each party may be represented by an individual of choice or legal counsel.
- E. The chairman, with the concurrence of the majority of the board present at a hearing, shall have the authority to limit evidence to that relevant to the issues. Any proofs, rebuttal, and cross examination which are immaterial, insubstantial, privileged, or repetitive may be excluded.
- F. The chairman may continue, adjourn, and reconvene the hearing as necessary.
- G. Decisions of the board shall be made based on a preponderance of the evidence placed before it.

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

4VAC25-20-430. Post-hearing procedures.

- A. The board may require submittal of briefs from the parties to a hearing concerning the issues of record before the board. The board shall schedule submittal of briefs at the time of the hearing.
- B. Transcripts of the proceeding shall be provided on request to any party to the hearing at cost. Motions to correct any transcript shall be filed within 10 working days after delivery of the transcript, and shall be ruled on by the chief within 10 working days after his receipt of the motion. Any corrections shall be sent to all parties to the hearing who have received a copy of the transcript.
- C. Decisions shall be rendered in writing and communicated to parties to the proceeding in accordance with the Administrative Process Act (§9-6.14:1 et seq. of the Code of Virginia).

Statutory Authority

§§[45.1-161.28](#), [45.1-161.29](#), [45.1-161.34](#) and [45.1-161.35](#) of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 13, Issue 22, eff. August 20, 1997.

FORMS

Advanced First Aid Practical Stations & CPR (Written & Practical), DM-BCME-5 (Issued 10/24/96).

Application for Certification Examination, DM-BCME-1 (Rev. 5/99).

Verification of Work Experience, DM-BCME-2 (Issued 2/1/96).

Verification of Training Completed for General Coal Miner Certification, DM-BCME-3 (Issued 2/1/96).

Application for Recertification: DMLR Endorsement/Blaster's Certification, DMLR-BCME-3 (Rev. 6/95).

Application for DMLR Endorsement: Blaster's Certification (Coal Surface Mining Operation), DMLR-BCME-4 (Rev. 6/95).

Application for Certification Examination: Mineral Mining -- Board of Mineral Mining Examiners, DM-BMME-1B (Rev. 2/94).

Certificate of Work Experience: Mineral Mining -- Board of Mineral Mining Examiners, DMM-BMME-2B (Rev. 2/94).

Verification for Training Completed for Continuing Education, DM-BCME-4 (Issued 5/31/96).